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DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

1163-270P

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/529304

INTERNATIONAL APPLICATION NO.

PCT/JP97/03846

INTERNATIONAL FILING DATE

October 23, 1997

PRIORITY DATE CLAIMED

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## TITLE OF INVENTION

IMAGE DECODING APPARATUS, IMAGE CODING APPARATUS, IMAGE COMMUNICATIONS SYSTEM AND CODED BIT  
STREAM CONVERTING APPARATUS

## APPLICANT(S) FOR DO/EO/US

ISU, Yoshimi; SEKIGUCHI, Shunichi; ASAI, Kohtaro; NISHIKAWA, Hirofumi; KURODA, Shinichi;\*

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39 (1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19<sup>th</sup> month from the earliest claimed priority date
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
- a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
- b. ☐ has been transmitted by the International Bureau.
- c. ☒ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(3)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(2)).
- a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
- b. ☐ have been transmitted by the International Bureau.
- c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
- d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

## Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.-1449 and International Search Report (PCT/ISA/210)
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.  
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:  
1.) Seventeen (17) sheets of Formal Drawings

U.S. APPLICATION NO (if known, see 37 CFR 1.5) <div style="font-size: 24pt; font-weight: bold;">09/529304</div>		INTERNATIONAL APPLICATION NO PCT/JP97/03846		<div style="text-align: right;"> <b>422 Rec'd PCT/PTO</b>  <b>12 APR 2000</b> </div> ATTORNEY'S DOCKET NUMBER 1163-270P	
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17. <input checked="" type="checkbox"/> The following fees are submitted: <b>BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5):</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO. .... <b>\$970.00</b>  International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... <b>\$840.00</b>  International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO. .... <b>\$690.00</b>  International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... <b>\$670.00</b>  International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4). .... <b>\$96.00</b> <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>	<b>CALCULATIONS      PTO USE ONLY</b>																					
	\$	840.00																				
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	\$	0																				
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:20%;">CLAIMS</th> <th style="width:20%;">NUMBER FILED</th> <th style="width:20%;">NUMBER EXTRA</th> <th style="width:20%;">RATE</th> </tr> <tr> <td>Total Claims</td> <td>10 - 20 =</td> <td>0</td> <td>X \$18.00</td> </tr> <tr> <td>Independent Claims</td> <td>5 - 3 =</td> <td>2</td> <td>X \$78.00</td> </tr> <tr> <td colspan="3">MULTIPLE DEPENDENT CLAIM(S) (if applicable)      None</td> <td>+ \$260.00</td> </tr> <tr> <td colspan="3" style="text-align: right;"><b>TOTAL OF ABOVE CALCULATIONS =</b></td> <td>\$ 996.00</td> </tr> </table>	CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	Total Claims	10 - 20 =	0	X \$18.00	Independent Claims	5 - 3 =	2	X \$78.00	MULTIPLE DEPENDENT CLAIM(S) (if applicable)      None			+ \$260.00	<b>TOTAL OF ABOVE CALCULATIONS =</b>			\$ 996.00	\$	0
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE																			
Total Claims	10 - 20 =	0	X \$18.00																			
Independent Claims	5 - 3 =	2	X \$78.00																			
MULTIPLE DEPENDENT CLAIM(S) (if applicable)      None			+ \$260.00																			
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Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).	\$	0																				
<b>SUBTOTAL =</b>	\$	996.00																				
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).	\$	0																				
<b>TOTAL NATIONAL FEE =</b>	\$	996.00																				
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00</b> per property +	\$	40.00																				
<b>TOTAL FEES ENCLOSED =</b>	\$	1036.00																				
	Amount to be: refunded	\$																				
	charged	\$																				

a. ☒ A check in the amount of \$ **1036.00** to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account. No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_ to cover the above fees.  
 A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any  
 overpayment to Deposit Account No. 02-2448.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

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 REGISTRATION NUMBER

/cgc

09/529304

422 Rec'd PCT/PTO 1 2 APR 2000

PATENT  
1163-270P

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: ISU, Yoshimi et al.  
Int'l. Appl. No.: PCT/JP97/03846  
Appl. No.: New Group:  
Filed: April 12, 2000 Examiner:  
For: IMAGE DECODING APPARATUS, IMAGE  
CODING APPARATUS, IMAGE  
COMMUNICATIONS SYSTEM AND CODED BIT  
STREAM CONVERTING APPARATUS

PRELIMINARY AMENDMENT

**BOX PATENT APPLICATION**

Assistant Commissioner for Patents  
Washington, DC 20231

April 12, 2000

Sir:

The following Preliminary Amendments and Remarks are respectfully submitted in connection with the above-identified application.

AMENDMENTS

IN THE SPECIFICATION:

Please amend the specification as follows:

Before line 1, insert --This application is the national phase under 35 U.S.C. § 371 of PCT International Application No. PCT/JP97/03846 which has an International filing date of October 23, 1997, which designated the United States of America.--

REMARKS

The specification has been amended to provide a cross-reference to the previously filed International Application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By 

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1163-270P

(Rev. 01/08/2000)

17/PARTS

09/529304  
422 Rec'd PCT/PTO 12 APR 2000

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## SPECIFICATION

### TITLE OF THE INVENTION

5           IMAGE DECODING APPARATUS, IMAGE CODING APPARATUS,  
          IMAGE COMMUNICATIONS SYSTEM AND  
          CODED BIT STREAM CONVERTING APPARATUS

### TECHNICAL FIELD

10           The present invention relates to an image decoding  
          apparatus, an image coding apparatus, an image communications  
          system and a coded bit stream converting apparatus, all of which  
          can handle coded bit streams with different coding schemes.

### 15   BACKGROUND ART

          A system based on the MPEG-4 (Moving Picture Experts Group  
          Phase-4) which is currently in progress toward standardization  
          in ISO/IEC JTC11/SC29/WG11 differs from a system based on ITU-T  
          Recommendation H.263 in header information (an information  
20   signal for decoding) to be added to a coded bit stream which  
          constitutes a transmitted signal.

          Fig. 1(a) is a diagram showing a structure of an H.263 coded  
          bit stream 201 based on the H.263 standard, into which header  
          information 211 is multiplexed along with macroblock data 225  
25   consisting of image coded data encoded according to the H.263  
          coding scheme. Fig. 1(b) is a diagram showing a structure of  
          an MPEG-4 coded bit stream 202, into which header information  
          212 is multiplexed along with macroblock data 239 consisting  
          of image coded data encoded according to the MPEG-4 coding scheme.  
30   As shown in these figures, they have different coded bit stream

structures. In particular, the H.263 does not include header information about VO (Video Object), VOL (Video Object Layer), VOP (Video Object Plane) and the like, which are required for MPEG-4 decoding. Accordingly, to carry out the image

5 communications based on the two schemes, separate image decoding apparatuses and image coding apparatuses are needed.

Here, it is not always necessary for a GOB start code 223 and GOB header information 224 in the H.263 coded bit stream 201, and resynchronization instruction code 237 and  
10 resynchronization information 238 in the MPEG-4 coded bit stream 202 to be inserted, but inserted as needed.

With such structures, the conventional coded bit streams present a problem in that an MPEG-4 compatible image decoding apparatus, for example, cannot decode the H.263 coded bit stream  
15 201 generated according to the H.263 standard.

Furthermore, to decode the coded bit streams according to the MPEG-4 and H.263 standard, an image decoding apparatus must comprise two decoders based on the two schemes, which presents a problem of complicating the apparatus.

20 The present invention is implemented to solve the foregoing problems. Therefore, an object of the present invention is to provide an image decoding apparatus capable of decoding the H.263 coded bit stream 201, an image coding apparatus for generating a coded bit stream decodable by the image decoding apparatus,  
25 and an image communications system and a coded bit stream converting apparatus for converting the H.263 coded bit stream to the MPEG-4 coded bit stream to carry out communication, all of which apparatuses have a simple structure.

30 DISCLOSURE OF THE INVENTION

According to a first aspect of the present invention, there is provided an image decoding apparatus for decoding a first coded bit stream into which first header information and image coded data encoded in a first coding scheme are multiplexed, or for decoding a second coded bit stream into which second header information and image coded data encoded in a second coding scheme are multiplexed, the image decoding apparatus comprising: coding scheme decision means for making a decision as to whether a received coded bit stream is the first coded bit stream or the second coded bit stream in response to the first header information or to the second header information; decoding means for decoding image coding information on the second coding scheme included in the second header information by receiving the second coded bit stream; and setting means for setting, by receiving the first coded bit stream, the image coding information on the second coding scheme in response to image coding information on the first coding scheme included in the first header information, wherein the image decoding apparatus decodes the image coded data included in the first coded bit stream or in the second coded bit stream in response to the image coding information set by the setting means or in response to the image coding information decoded by the decoding means.

This offers an advantage of being able to decode the coded bit streams based on the different coding schemes.

In the image decoding apparatus in accordance with the present invention, the coding scheme decision means can make the decision in response to coding scheme identification information for identifying the first or second coding scheme, the coding scheme identification information being included in the first header information or in the second header information.

This offers an advantage of being able to decode the coded bit streams based on the different coding schemes with readily identifying the coding schemes.

5 In the image decoding apparatus in accordance with the present invention, the coding scheme decision means can make the decision in response to a start code included in the first header information or in the second header information.

10 This offers an advantage of being able to decode the coded bit streams based on the different coding schemes with readily identifying the coding schemes.

15 In the image decoding apparatus in accordance with the present invention, the coding scheme decision means can make the decision in response to an H.263 start code included in the first header information, or to a VOL (Video Object Layer) start code included in the second header information.

This offers an advantage of being able to decode the coded bit streams based on the H.263 and MPEG-4 coding schemes with readily identifying the coding schemes.

20 In the image decoding apparatus in accordance with the present invention, the coding scheme decision means can make the decision in response to a picture start code included in the first header information, or to a VO (Video Object) start code included in the second header information.

25 This offers an advantage of being able to decode the coded bit streams based on the H.263 and MPEG-4 coding schemes with readily identifying the coding schemes without adding new header information.

30 According to a second aspect of the present invention, there is provided an image coding apparatus comprising: coding means for generating a first coded bit stream by encoding an image



signal in a first coding scheme; and header information multiplexing means for multiplexing, into the first coded bit stream, header information for ensuring compatibility with a second coded bit stream encoded in a second coding scheme.

5 This offers an advantage of being able to generate the first coded bit stream that can be decoded by the decoder for decoding the second coded bit stream.

10 In the image coding apparatus according to the present invention, the header information multiplexing means can multiplex, as the header information for ensuring the compatibility, a start code of the second coding scheme, and coding scheme identification information indicative of the first coding scheme.

15 This offers an advantage of being able to generate the first coded bit stream the decoder for decoding the second coded bit stream can decode with readily identifying the coding scheme.

20 According to a third aspect of the present invention, there is provided an image communications system comprising: coding means for generating a first coded bit stream by encoding an image signal in a first coding scheme; decoding means for decoding a second coded bit stream coded in a second coding scheme; and coded bit stream converting means for transmitting the first coded bit stream received from the coding means to the decoding means, after multiplexing into the first coded bit stream header information for ensuring compatibility, which is  
25 received from the decoding means.

This offers an advantage of being able to generate the first coded bit stream the decoder for decoding the second coded bit stream can decode with readily identifying the coding scheme.

30 According to a fourth aspect of the present invention, there

is provided a coded bit stream converting apparatus comprising:  
 syntax analyzing means for inputting a first coded bit stream  
 generated in a first coding scheme, and for extracting first  
 header information in the first coding scheme and image coded  
 5 data; decoding means for decoding the first header information  
 extracted; header information setting means for setting and  
 coding second header information in a second coding scheme in  
 response to the first header information decoded by the decoding  
 means; and multiplexing means for generating a second coded bit  
 10 stream by multiplexing image coded data extracted by the syntax  
 analyzing means with the second header information coded by the  
 header information setting means.

This offers an advantage of being able to readily convert  
 the first coded bit stream to the second coded bit stream.

15 According to a fifth aspect of the present invention, there  
 is provided an image decoding apparatus for decoding a first  
 coded bit stream into which first header information and image  
 coded data encoded in a first coding scheme are multiplexed,  
 or for decoding a second coded bit stream into which second header  
 20 information and image coded data encoded in a second coding  
 scheme are multiplexed, the image decoding apparatus comprising:  
 coding scheme decision means for making a decision as to whether  
 a received coded bit stream is the first coded bit stream or  
 the second coded bit stream in response to the first header  
 25 information or to the second header information; first decoding  
 means for decoding the first header information by receiving  
 the first coded bit stream; and second decoding means for  
 decoding image coding information on the second coding scheme  
 included in the second header information by receiving the second  
 30 coded bit stream, wherein the image decoding apparatus decodes,

when the coded bit stream received is the first coded bit stream,  
 the image coded data included in the first coded bit stream in  
 response to the first header information decoded by the first  
 decoding means, and decodes, when the coded bit stream received  
 5 is the second coded bit stream, the image coded data included  
 in the second coded bit stream in response to the image coding  
 information decoded by the second decoding means.

This offers an advantage of being able to decode the coded  
 bit streams based on the different coding schemes with readily  
 10 identifying the coding schemes without adding new header  
 information, and to decode the first coded bit stream without  
 setting the image coding information on the second coding scheme.

#### BRIEF DESCRIPTION OF THE DRAWINGS

15 Fig. 1 is a diagram showing a structure of a conventional  
 H.263 coded bit stream and a structure of an MPEG-4 coded bit  
 stream;

Fig. 2 is a diagram showing structures of a coded bit stream  
 received by the image decoding apparatus of an embodiment 1 in  
 20 accordance with the present invention;

Fig. 3 is a block diagram showing a configuration of the  
 image decoding apparatus of the embodiment 1 in accordance with  
 the present invention;

Fig. 4 is a block diagram showing a configuration of the  
 25 syntax analysis/variable length decoder in the embodiment 1 in  
 accordance with the present invention;

Fig. 5 is a block diagram showing a configuration of the  
 header information analyzer in the embodiment 1 in accordance  
 with the present invention;

30 Fig. 6 is a block diagram showing a configuration of the

H.263 picture header information analyzer in the embodiment 1 in accordance with the present invention;

Fig. 7 is a block diagram showing a configuration of the H.263 picture header information decoder in the embodiment 1 in accordance with the present invention;

Fig. 8 is a block diagram showing a configuration of the H.263 GOB header information analyzer in the embodiment 1 in accordance with the present invention;

Fig. 9 is a diagram illustrating a GOB;

Fig. 10 is a block diagram showing a configuration of the GOB header information decoder in the embodiment 1 in accordance with the present invention;

Fig. 11 is a diagram showing a layer structure of H.263 macroblock data;

Fig. 12 is a block diagram showing a configuration of the macroblock layer syntax analyzer in the embodiment 1 in accordance with the present invention;

Fig. 13 is a block diagram showing a configuration of the block data decoder in the embodiment 1 in accordance with the present invention;

Fig. 14 is a diagram illustrating calculation of a prediction vector;

Fig. 15 is a block diagram showing a configuration of the texture decoder in the embodiment 1 in accordance with the present invention;

Fig. 16 is a block diagram showing a configuration of the inverse quantizer in the embodiment 1 in accordance with the present invention;

Fig. 17 is a block diagram showing a configuration of an image coding apparatus of embodiments 2 and 4 in accordance with

the present invention;

Fig. 18 is a diagram illustrating a relationship between an H.263 encoder and an MPEG-4 decoder in the embodiments 2 and 4 in accordance with the present invention;

5 Fig. 19 is a diagram showing contents of an MPEG-4 compatible H.263 coded bit stream in an embodiment 3 in accordance with the present invention;

Fig. 20 is a block diagram showing a configuration of a header information analyzer in the embodiment 3 in accordance  
10 with the present invention;

Fig. 21 is a diagram showing an image communications system of an embodiment 5 in accordance with the present invention;

Fig. 22 is a diagram showing an image communications system of an embodiment 6 in accordance with the present invention;

15 Fig. 23 is a block diagram showing a configuration of a header information analyzer of an embodiment 7 in accordance with the present invention 7;

Fig. 24 is a diagram illustrating the start and end of a coded bit stream in the embodiment 7 in accordance with the  
20 present invention;

Fig. 25 is a block diagram showing a coded bit stream converting apparatus of an embodiment 8 in accordance with the present invention; and

Fig. 26 is a diagram showing a structure of GOB header  
25 information and a structure of resynchronization information.

#### BEST MODE FOR CARRYING OUT THE INVENTION

The invention will now be described in more detail with reference to the accompanying drawings.

30 EMBODIMENT 1

Fig. 2 is a diagram showing structures of a coded bit stream received by an image decoding apparatus of an embodiment 1, wherein Fig. 2(a) shows an MPEG-4 compatible H.263 coded bit stream 203, and Fig. 2(b) shows an MPEG-4 coded bit stream 204.

5 The MPEG-4 compatible H.263 coded bit stream 203 as shown in Fig. 2(a) includes, in addition to the conventional H.263 coded bit stream 201 as shown in Fig. 1(a), a VO start code 231, a VO identification number 232, a VOL start code 233 and H.263 compatible identification information 226. The MPEG-4 coded bit stream 204 as shown in Fig. 2(b) includes, in addition to the conventional MPEG-4 coded bit stream 202 as shown in Fig. 1(b), H.263 compatible identification information 226. The H.263 compatible identification information 226 added to the MPEG-4 compatible H.263 coded bit stream 203 is distinguishable from that added to the MPEG-4 coded bit stream 204 because one of the H.263 compatible identification information is placed at "0", and the other information at "1".

Fig. 3 is a block diagram showing a configuration of an image decoding apparatus for decoding a VO (Video Object) in the embodiment 1. In Fig. 3, the reference numeral 1 designates a received coded bit stream; and 2 designates a syntax analysis/variable length decoder that analyzes in the coded bit stream 1 syntax (a multiplexed video signal), and outputs geometry coded data 3, texture coded data 6 and texture motion data 7. The reference numeral 4 designates a geometry decoder for obtaining decoded geometry data 5 by decoding the geometry coded data 3; 8 designates a motion compensator for carrying out motion compensation in response to the texture motion data 7 to obtain prediction texture data 9; and 10 designates a texture decoder for carrying out decoding in response to the texture

coded data 6 and prediction texture data 9 to obtain decoded texture data 11.

Next, the operation will be described.

Here, decoding operation of the MPEG-4 compatible H.263  
 5 coded bit stream 203 as shown in Fig. 2(a), which is a subject  
 matter of the present invention, will be chiefly described. In  
 other words, a case will be described, in which shapes of  
 individual VOPs are rectangular, that is, no bit stream includes  
 geometry coded data, and the texture data or information about  
 10 motion is encoded on a macroblock basis.

Incidentally, the basic operation for decoding the MPEG-4  
 coded bit stream 204 as shown in Fig. 2(b) is the same as the  
 conventional operation.

First, the syntax analysis/variable length decoder 2  
 15 translates the input coded bit stream 1 from a binary bit stream  
 to intelligible data. Thus, the syntax analysis/variable length  
 decoder 2 enables the MPEG-4 compatible H.263 coded bit stream  
 203 to be decoded. The motion compensator 8 carries out the  
 motion compensation in response to the texture motion data 7  
 20 output from the syntax analysis/variable length decoder 2, and  
 outputs the prediction texture data 9. The texture decoder 10  
 receives the texture coded data 6 output from the syntax  
 analysis/variable length decoder 2 and the prediction texture  
 data 9 output from the motion compensator 8, and obtains the  
 25 decoded texture data 11.

Next, the operation of the syntax analysis/variable length  
 decoder 2 will be described.

Fig. 4 is a block diagram showing a configuration of the  
 syntax analysis/variable length decoder 2. In this figure, the  
 30 reference numeral 21 designates a header information analyzer

for extracting the header information added to the coded bit stream 1, and for setting various pieces of header information required for the subsequent decoding control; 22 designates a macroblock layer syntax analyzer for obtaining the texture coded data 6 and texture motion data 7 from the coded bit stream 1.

Fig. 5 is a block diagram showing a configuration of the header information analyzer 21. In this figure, the reference numeral 30 designates a VO start code detector coded for detecting the VO start code 231 in the bit stream 1; 31 designates a VOL start code detector for detecting the VOL start code 233 from the coded bit stream 1; and 32 designates a coding scheme decision section for making a decision as to whether the coded bit stream 1 is the MPEG-4 compatible H.263 coded bit stream 203 or the MPEG-4 coded bit stream 204, and for outputting H.263 compatible identification information 33. The reference numeral 34 designates a switching section switched in response to the decided coding scheme; 35 designates an H.263 picture header information analyzer for decoding from the MPEG-4 compatible H.263 coded bit stream 203 the picture header information 222 which is the image coding information unique to the H263 system, and for setting the VOL header information 234 and VOP header information 236 which are the image coding information unique to the MPEG-4 system; 36 designates an H.263 GOB header information analyzer for decoding from the MPEG-4 compatible H.263 coded bit stream 203 the H.263 GOB (Group of Block) header information 224, and for updating, in response to the GOB header information 224 decoded, the VOP header information 236 set by the H.263 picture header analyzer 35; 37 designates a VOL header information decoder for decoding the VOL header information 234 from the MPEG-4 coded bit stream 204;



and 38 designates a VOP header information analyzer for decoding the VOP header information 236 from the MPEG-4 coded bit stream 204.

Next, the operation of the header information analyzer 21 will be described.

Detecting the VO start code 231 in the MPEG-4 compatible H.263 coded bit stream 203 or in the MPEG-4 coded bit stream 204 as shown in Fig. 2, the VO start code detector 30 starts the following decoding operation. Specifically, the VOL start code detector 31 detects the VOL start code 233 in the coded bit stream 1. The coding scheme decision section 32 decodes from the coded bit stream 1 the H.263 compatible identification information 226, and makes a decision from the H.263 compatible identification information 226 as to whether the coded bit stream 1 is the MPEG-4 compatible H.263 coded bit stream 203 or the MPEG-4 coded bit stream 204, thereby outputting the H.263 compatible identification information 33.

When the coded bit stream 1 is the MPEG-4 compatible H.263 coded bit stream 203, the switching section 34 supplies the coded bit stream 1 to the H.263 picture header information analyzer 35.

Fig. 6 is a block diagram showing a configuration of the H.263 picture header information analyzer 35. When an H.263 picture start code detector 41 detects the picture start code 221 in the coded bit stream 1, a subsequent H.263 picture header information decoder 42 decodes the picture header information 222 from the coded bit stream 1. Then, an MPEG-4 header information setting section 43 sets the VOL header information 234 and VOP header information 236 in response to the picture header information 222 decoded.

Fig. 7 is a block diagram showing a configuration of the H.263 picture header information decoder 42. A temporal reference (TR) decoder 51 receives the bit stream 1 from the H.263 picture start code detector 41, and decodes the number of pictures (TR) that are skipped or not referred to among the transmitted pictures. This information is used for display as needed.

Next, a picture type (PTYPE) decoder 52 decodes the picture type (PTYPE). The picture type includes information such as a picture format 301, a picture coding type 302 and an optional mode indication flag 303. The picture format 301 and picture coding type 302 decoded are supplied to the MPEG-4 header information setting section 43 shown in Fig. 6.

The picture type (PTYPE) decoder 52 makes a decision as to whether the optional mode indication flag 303 is ON or not. Although the H.263 standard offers several optional modes, the image decoding apparatus described in the present embodiment does not ensure the compatibility between bit streams containing the optional modes. Thus, the coded bit stream with the optional mode being ON (valid) is supplied to a decoding operation terminating section 54 through a switching section 53 so that the decoding operation terminating section 54 completes the decoding operation of the coded bit stream. The picture type includes information defining display or others, which are available as need.

In contrast, the bit stream with the optional mode being OFF (invalid) is supplied to a picture quantization step size (PQUANT) decoder 55 through the switching section 53. The picture quantization step size (PQUANT) decoder 55 decodes a picture quantization step size (PQUANT) 304. The picture

quantization step size 304 decoded is supplied to the MPEG-4 header information setting section 43 shown in Fig. 6. The picture header information after the picture quantization step size 304 is skipped because it is not required in the subsequent decoding.

Next, the operation of the MPEG-4 header information setting section 43 as shown in Fig. 6 will be described.

The MPEG-4 header information setting section 43 sets, in response to the picture header information 222 decoded, VOL geometry information and object size as the VOL header information 234. It also sets, in the case of the MPEG-4 compatible H.263 coded bit stream, the information indicating that the geometry information represents rectangles, in which case, the individual bit streams correspond to frames each.

Furthermore, since the object size corresponds to the frame size, the MPEG-4 header information setting section 43 obtains the frame size from the picture format 301, one of the picture header information 222, and sets the object size. In addition, it also sets information about whether the gray scale per pixel is eight bits or not. Because the H.263 system assumes that the gray scale per pixel is always eight bits, it is placed at eight bits.

Next, the MPEG-4 header information setting section 43 invalidates the MPEG-4 based coding conditions, that is, the sprite coding, error resistant coding, intra AC/DC prediction and scalability coding. Because the MPEG-4 can select its quantization scheme from the two schemes H.263 and MPEG-1/2, the quantization scheme is set in advance at the H.263 when using the MPEG-4 compatible H.263 coded bit stream 203.

Furthermore, the MPEG-4 header information setting section 43 sets the VOP header information 236. Specifically, it sets

as the VOP header information 236, the VOP prediction type information and quantization step size. The VOP prediction type includes intra coding that uses only the data within the VOP, and inter coding that also uses data before and after the VOP.

5 The VOP prediction type information is set in response to a picture coding type 302, one of the picture header information 222. Besides, the VOP quantization step size is set in accordance with a picture quantization step size 304, one of the picture header information 222.

10 Moreover, because the MPEG-4 can select its motion vector search range from seven types, it has a code for designating the motion vector search range. However, since the H.263 corresponds to only one of the search ranges, it is necessary for the MPEG-4 header information setting section 43 to set the motion vector search range designation code corresponding to  
15 the motion vector search range the H.263 employs. In addition, although the MPEG-4 is interlace image compatible, the H.263 is interlace incompatible. Thus, interlace mode indication information is always set invalid.

20 After the H.263 picture header information analyzer 35 as shown in Fig. 5 completes the analysis of the picture header information, the H.263 GOB header information analyzer 36 starts the analysis of the GOB header information 224, when the coded bit stream includes the GOB start code 223 and GOB header  
25 information 224. When the coded bit stream does not include the GOB start code 223 or GOB header information 224, the H.263 GOB header information analyzer 36 does not operate.

Fig. 8 is a block diagram showing a configuration of the H.263 GOB header information analyzer 36 as shown in Fig. 5.

30 When a GOB start code detector 61 detects the GOB start code

223 attached to the coded bit stream 1, a GOB header information decoder 62 decodes the GOB header information 224.

Fig. 9 illustrates GOBs. As shown in this figure, each GOB includes a series of macroblocks formed by dividing an image, and the GOB header information 224 includes information required for establishing resynchronization at a decoding side. A bit error in the coded bit stream will propagate to subsequent macroblock data in the case of variable length coding or prediction coding, thereby impairing correct decoding. The detection of the GOB header information can prevent the propagation of the error because it establishes the resynchronization of the coded bit stream before decoding the initial macroblock of the GOB, and thus resets the information needed for decoding the successive macroblocks. The quantization step size and the motion vector of each macroblock must be reset when the resynchronization is established, because they undergo the prediction coding that codes the differences between the quantization step sizes and between the motion vectors of the current and previous coded macroblocks.

Fig. 10 is a block diagram showing a configuration of a GOB header information decoder 62. A GOB number decoder 71 decodes a GOB number (GN) from the coded bit stream 1. A GOB frame identification number decoder 72 decodes the identification number (GFID) of a picture to which the GOB belongs. A GOB quantization step size decoder 73 decodes a GOB quantization step size (GQUANT) 305, and supplies it to an MPEG-4 header information update section 63 as shown in Fig. 8.

The MPEG-4 header information update section 63 updates, in response to the decoded GOB header information 224, the VOP header information 236 set by the MPEG-4 header information

setting section 43. It is the quantization step size that is updated in response to the GOB header information 224. Thus, the GOB quantization step size is placed at the VOP quantization step size. The foregoing pieces of information that are set are  
 5 supplied to the macroblock layer syntax analyzer 22 as shown in Fig. 4.

The coding scheme decision section 32 as shown in Fig. 5 makes a decision, when the H.263 compatible identification information 226 indicates the MPEG-4, that the coded bit stream  
 10 1 is the MPEG-4 coded bit stream 204, and outputs the H.263 compatible identification information 33. The MPEG-4 coded bit stream 204 is supplied to the VOL header information decoder 37 through the switching section 34. The VOL header information decoder 37 decodes the VOL header information 234 from the coded  
 15 bit stream, and the VOP header information analyzer 38 decodes the VOP header information 236, and supplies it to the macroblock layer syntax analyzer 22 of Fig. 4.

After setting the foregoing information, the macroblock layer syntax analyzer 22 decodes the macroblock data 225 or 239  
 20 through the analysis based on the MPEG-4 syntax. However, since the coding scheme of the block data differs a little between the MPEG-4 and H.263, the decoding side must also switch the operation mode.

Fig. 11 is a diagram showing a layer structure of the  
 25 macroblock data 225 in the MPEG-4 compatible H.263 bit stream 203 in the present embodiment 1. The macroblock consists of four luminance blocks and two color difference blocks. As shown in Fig. 11, each macroblock includes macroblock skip decision information 251, macroblock type/valid color difference block  
 30 identification information 252, valid block identification

information 253, differential quantization step size 254 and motion data 255, which are multiplexed as attribute information.

Here, the macroblock skip decision information 251 indicates whether the motion vector is zero and all the  
 5 coefficient data within the macroblock in the inter VOP are zero (the coefficient data are obtained by passing the input image signal (the original signal when intra coded, and the differential signal between it and a reference VOP when inter coded) through the DCT, and then through the quantization). When  
 10 the motion vector is zero and all the coefficient data are zero, the subsequent information about the macroblock is excluded from the bit stream, and skipping to the next macroblock is carried out.

The macroblock type in the macroblock type/valid color  
 15 difference block identification information 252 indicates a macroblock coding type when the macroblock data is coded using the original signal of the macroblock (intra), or when the differential signal between the macroblock and the reference macroblock is coded after the motion compensation prediction  
 20 (inter), or when the current macroblock is coded using the quantization step size different from the quantization step size of the immediately previous macroblock.

The valid block identification information 253 indicates whether the coefficient data of the blocks are all zero or not.  
 25 Although the foregoing attribute information is followed by coefficient data (corresponding to block data 256) multiplexed into each block, the coefficient data of the block is absent when the valid block identification information 253 indicates that it is a invalid block.

30 The differential quantization step size 254 is information

5 multiplexed when the macroblock type indicates that the quantization step size of the current macroblock differs from that of the immediately preceding macroblock, and indicates the differential value from the quantization step size of the preceding macroblock.

Fig. 12 is a block diagram showing a configuration of the macroblock layer syntax analyzer 22. In this figure, the reference numeral 81 designates a switching section that is switched in response to geometry information 311 set by the MPEG-4 header information setting section 43; 82 designates a geometry coded data decoder for decoding the geometry coded data in the coded bit stream; 83 designates a switching section that is switched in response to VOP prediction type 312 set by the MPEG-4 header information setting section 43; 84 designates a skip decision information decoder for decoding, when the VOP prediction type is other than the intra coding, the macroblock skip decision information 251; 85 designates a switching section that is switched in response to the skip decision information 251; 86 designates a skip associated data setting section for placing all the motion vector and texture data in the macroblock to zero when skipping; and 87 designates a macroblock type/valid color difference block identification information decoder for decoding macroblock type 313 and valid color difference block identification information when the VOP prediction type 312 is intra or the skipping is not carried out.

The reference numeral 88 designates a switching section that is switched in response to intra AC/DC prediction mode indication information 315 set by the MPEG-4 header information setting section 43; 89 designates an AC prediction indication information decoder for decoding AC prediction indication



information; 90 designates a valid block identification information decoder for decoding the valid block identification information 253; and 91 designates a switching section that is switched in response to the macroblock type 313 output from the macroblock type/valid color difference block identification information decoder 87.

The reference numeral 92 designates a differential quantization step size zero setting section for placing the differential quantization step size to zero; 93 designates a differential quantization step size decoder for decoding a differential quantization step size 317; 94 designates an adder for adding the differential quantization step size 317 and a VOP quantization step size 318 of the previous block, and supplies a quantization step size 319 to the texture decoder 10 of Fig. 3; 95 designates a switching section that is switched in response to interlace mode indication information 316 fed from the MPEG-4 header information setting section 43; 96 designates an interlace information decoder for decoding interlace information; 97 designates a motion vector decoder for decoding a motion vector (texture motion data 7) in response to the macroblock type 313 output from the macroblock type/valid color difference block identification information decoder 87, to the VOP prediction type 312 output from the MPEG-4 header information setting section 43 and to motion vector search range designation information 320; and 98 designates a block data decoder for decoding the coded block data, and supplies the texture coded data 6 to the texture decoder 10.

Next, the operation of the macroblock layer syntax analyzer 22 will be described.

The following description will be made for the coded bit

stream 1 consisting of the MPEG-4 compatible H.263 coded bit stream 203. As for the MPEG-4 coded bit stream 204, the description will be omitted here because it is described in the ISO/IEC JTC1/SC29/WG11 MPEG-4 Video VM8.0.

5 First, the switching section 81 switches the output of the coded bit stream 1 in response to the geometry information 311 set by the MPEG-4 header information setting section 43. When the coded bit stream 1 consists of the MPEG-4 compatible H.263 coded bit stream 203, the geometry information 311 is rectangular, and hence the bit stream 1 is directly supplied to the switching  
10 section 83 without passing through the geometry coded data decoder 82.

Subsequently, the switching section 83 carries out its switching in response to the VOP prediction type 312 set by the  
15 MPEG-4 header information setting section 43. When the VOP prediction type 312 is intra, the macroblock type/valid color difference block identification information decoder 87 decodes the macroblock type 313 and the valid color difference block identification information. When the VOP prediction type is  
20 other than intra, the skip decision information decoder 84 decodes the skip decision information 251 of the macroblock. The skip decision information 251 decoded switches the switching section 85 such that when it indicates that the macroblock is to be skipped, the skip associated data setting section 86 places  
25 both the motion vector of the macroblock and the texture data in the macroblock all at zero, and completes the decoding of the macroblock. In contrast, when the skip decision information 251 indicates that the macroblock must not be skipped, the macroblock type/valid color difference block identification  
30 information decoder 87 decodes the macroblock type 313 and the

valid color difference block identification information.

Next, the switching section 88 is switched in response to the intra AC/DC prediction mode indication information 315 set by the MPEG-4 header information setting section 43. As for the  
 5 MPEG-4 compatible H.263 coded bit stream 203, because it does not have a function to carry out the intra AC/DC prediction, and hence the intra AC/DC prediction is set invalid when setting the VOL header information 234, it is supplied to the valid block identification information decoder 90 without passing through  
 10 the AC prediction indication information decoder 89.

The valid block identification information decoder 90 decodes the valid block identification information 253 for the luminance block in the macroblock. The switching section 91 is switched in response to the macroblock type 313 decoded by the  
 15 macroblock type/valid color difference block identification information decoder 87 so that when the quantization step size of the instant macroblock differs from that of the first previous macroblock, the differential quantization step size decoder 93 decodes the differential quantization step size 317 between the  
 20 quantization step size of the instant macroblock and that of the first previous macroblock. The differential quantization step size 317 decoded is added to the VOP quantization step size 318 of the first previous macroblock by the adder 94, and the sum is supplied to the texture decoder 10 of Fig. 3 as the  
 25 quantization step size 319.

In contrast, when the quantization step size of the current macroblock equals that of the first previous macroblock, the differential quantization step size zero setting section 92 places the differential quantization step size at zero.

30 Subsequently, the switching section 95 is switched in

response to the interlace mode indication information 316 fed from the MPEG-4 header information setting section 43. As for the MPEG-4 compatible H.263 coded bit stream 203, because it does not correspond to the interlace image, the interlace mode is set invalid, and hence it is supplied to the motion vector decoder 97 without passing through the interlace information decoder 96. The motion vector decoder 97 decodes, when the VOP prediction type 312 set by the MPEG-4 header information setting section 43 is inter, the motion vector (texture motion data 7) in response to the macroblock type 313 decoded by the macroblock type/valid color difference block identification information decoder 87 and to the motion vector search range designation information 320 set by the MPEG-4 header information setting section 43, and supplies the motion vector to the motion compensator 8 of Fig. 3.

Subsequently, the block data decoder 98 decodes the coded block data in the coded bit stream. Fig. 13 is a block diagram showing a configuration of the block data decoder 98. In this figure, the reference numeral 101 designates a switching section that receives the coded block data, and is switched in response to the macroblock type 313 fed from the macroblock type/valid color difference block identification information decoder 87; 102 designates a switching section that is switched in response to the intra AC/DC prediction mode indication information 315 set by the MPEG-4 header information setting section 43; 103 designates a DC coefficient fixed length decoder that carries out, when the intra AC/DC prediction is OFF, the DC coefficient fixed length decoding in response to gray scale per pixel 321 fed from the MPEG-4 header information setting section 43, and outputs a decoded intra DC coefficient 111; and 104 designates

a DC coefficient decoder that decodes the DC coefficient when the intra AC/DC prediction is ON, and outputs the decoded intra DC coefficient 111.

The reference numeral 105 designates a switching section  
 5 that is switched in response to the valid block identification information 253 fed from the valid block identification information decoder 90; and 106 designates an AC coefficient VLD table switching section for switching an AC coefficient VLD (Variable Length Decoding) table in response to the macroblock  
 10 type 313 fed from the macroblock type/valid color difference block identification information decoder 87 and to the H.263 compatible identification information 33 fed from the coding scheme decision section 32.

The reference numeral 107 designates an AC coefficient data  
 15 variable length decoder that carries out the variable length decoding of the AC coefficient data, and outputs decoded AC coefficient data 112; 108 designates a switching section that is switched in response to the H.263 compatible identification information 33 fed from the coding scheme decision section 32;  
 20 109 designates an AC coefficient data fixed length decoder for outputting the decoded AC coefficient data 112; 110 designates an AC coefficient data Esc coding decoder for outputting the decoded AC coefficient data 112; and 113 designates an AC coefficient zero setting section for placing the AC coefficient  
 25 at zero.

Next, the operation of the block data decoder 98 will be described.

First, the coded block data is switched by the switching section 101 in response to the macroblock type 313 fed from the  
 30 macroblock type/valid color difference block identification

information decoder 87 such that it is supplied to the switching section 105 when the macroblock type 313 is other than intra. When the macroblock type 313 is intra, the coded block data is supplied to the switching section 102 which is switched in response to the intra AC/DC prediction mode indication information 315 set by the MPEG-4 header information setting section 43.

As for the MPEG-4 compatible H.263 coded bit stream 203, because the intra AC/DC prediction mode 315 is set invalid, it does not pass through the DC coefficient decoder 104, but is supplied to the DC coefficient fixed length decoder 103. The DC coefficient fixed length decoder 103 carries out the fixed length decoding, and supplies the decoded intra DC coefficient 111 to the texture decoder 10, and the coded block data to the switching section 105. In this case, the length of the code passing through the fixed length decoding equals the gray scale per pixel (the default is 8 bits) 321 set by the MPEG-4 header information setting section 43. Since the gray scale per pixel 321 has the default of 8 bits, it equals that of the H.263 decoder.

The switching section 105 is switched in response to the valid block identification information 253 decoded by the valid block identification information decoder 90 such that when the block is invalid, the AC coefficient zero setting section 113 places the decoded AC coefficient data 112 in the block at zero, and supplies it to the texture decoder 10. When the block is valid, the coded block data is supplied to the AC coefficient VLD table switching section 106.

The AC coefficients in the block undergo the variable length coding by the encoder side that scans the coefficients in the block in a predetermined sequence, and encodes them with

generating a combination consisting of a flag (LAST) indicating whether a non-zero coefficient is the final one in the block, and of the number of consecutive zeros (RUN) and the level of the successive non-zero coefficients (LEVEL). The decoder side carries out the variable length decoding of the coded data to obtain the combination (LAST, RUN and LEVEL) so that it can reproduce the AC coefficients in the block. Incidentally, when carrying out the variable length coding of the combination (LAST, RUN and LEVEL), although the MPEG-4 performs the variable length coding using different VLC (Variable Length Coding) tables in accordance with the macroblock type, the H.263 carries out the variable length coding using the same VLC table independently of the macroblock type.

Thus, in the image decoding apparatus in the present embodiment, the AC coefficient VLD table switching section switches the AC coefficient VLD table in response to the macroblock type fed from the macroblock type/valid color difference block identification information decoder 87 and the H.263 compatible identification information 33 fed from the coding scheme decision section 32. When the H.263 compatible identification information 33 is set at the H.263, the AC coefficient data variable length decoder 107 carries out the variable length decoding using the single VLD table regardless of the macroblock type (intra or inter) 313, and supplies the decoded AC coefficient data 112 to the texture decoder 10 as the coded texture data 6.

The coding scheme in the case where the combination (LAST, RUN and LEVEL) is not present in the VLC table also differs in the MPEG-4 and in the H.263. When the combination (LAST, RUN and LEVEL) is not present in the VLC table, the MPEG-4 encodes

the Escape code followed by the value correction of the RUN or LEVEL, and carries out either the variable length coding or the fixed length coding. In contrast, the H.263 encodes the Escape code, and then carried out the fixed length coding of the values  
 5 of the LAST, RUN and LEVEL.

Thus, in the image decoding apparatus of the present embodiment, when the AC coefficient data variable length decoder 107 detects the Escape code in the AC coefficient coded data, it supplies the coded bit stream to the switching section 108.  
 10 When the H.263 compatible identification information 33 is set at the H.263, the coded bit stream is supplied not to the AC coefficient data Esc coding decoder 110 but to the AC coefficient data fixed length decoder 109 so that it carries out the fixed length decoding of the subsequent code about the LAST, RUN and  
 15 LEVEL in their predetermined code length, and supplies the decoded AC coefficient data 112 to the texture decoder 10 as the texture coded data 6.

By the foregoing operation, the texture coded data 6 and the motion vector (texture motion data 7) output from the  
 20 macroblock layer syntax analyzer 22 are delivered to the texture decoder 10 and the motion compensator 8, respectively.

As described above, the syntax analysis/variable length decoder 2 as shown in Fig. 3 decodes and establishes the VOP prediction mode. When the VOP prediction mode is inter, the  
 25 differential vector in the texture motion vector is decoded. The differential vector in the texture motion vector decoded is the differential vector between the prediction vector obtained from motion vectors of three neighboring macroblocks and the actual motion vector. Thus, the motion vector (texture  
 30 motion data 8) is calculated by adding the differential vector



of the motion vector to the prediction vector.

The prediction vector is calculated from the motion vectors of the three neighboring macroblocks (MV1, MV2 and MV3), which have already been decoded as shown in Fig. 14(a). When any one of the three neighboring macroblocks is located outside the VOP, the motion vector of the macroblock outside the VOP is placed at the zero vector as shown in Fig. 14(b) or 14(d). Alternatively, it can be set using the motion vector of the same macroblock in the VOP as shown in Fig. 14(c). However, when the coding scheme is H.263, and the GOB header is defined, it is necessary for the prediction vector to be set within the boundary of the GOB. The prediction vector is set as in the VOP. In response to the decoded vector, the prediction vector is extracted as the prediction texture data 9 to be output to the texture decoder 10.

In contrast, when the VOP prediction mode is intra, the motion compensation prediction is not carried out.

The texture decoder 10 receives the texture coded data 6, and restores the texture data 11.

Fig. 15 is a block diagram showing a configuration of the texture decoder 10. An inverse quantizer 114 carries out the inverse quantization of the texture coded data 6.

Fig. 16 is a block diagram showing a configuration of the inverse quantizer 114.

A switching section 117 is switched in response to the macroblock type 313 contained in the texture coded data 6. Because the texture coded data 6 is not included in the DC coefficient data when the macroblock type 313 of the block to be decoded is the inter coded mode, the texture coded data 6 is directly supplied to an AC coefficient inverse quantizer 120.

In contrast, when the macroblock type 313 of the block to be decoded is intra coded mode, the texture coded data 6 is supplied to the switching section 118.

The switching section 118 is switched in response to the H.263 compatible identification information 33. When the H.263 compatible identification information 33 indicates the MPEG-4 compatible H.263 coded bit stream 203, a DC coefficient linear inverse quantizer 119B carries out the inverse quantization of the DC coefficient data contained in the texture coded data 6.

On the other hand, when the H.263 compatible identification information 33 indicates the MPEG-4 coded bit stream 204, the DC coefficient non-linear inverse quantizer 119A carries out the inverse quantization of the DC coefficient data, and outputs a DC coefficient 306. The DC coefficient quantization is carried out by dividing the DC coefficient by a predetermined value (called quantization scale), and by dropping the fractional portion. Therefore, the decoding side can restore the DC coefficient 306 by multiplying the quantization DC coefficient by the quantization scale. The DC coefficient linear inverse quantizer 119B differs from the DC coefficient non-linear inverse quantizer 119A in the setting of the value of the quantization scale. The DC coefficient linear inverse quantizer 119B carries out the inverse quantization using a fixed value 8 as the quantization scale. In contrast, the DC coefficient non-linear inverse quantizer 119A non-linearly establishes the value of the quantization scale in accordance with the range of the quantization step size 319, and carries out the inverse quantization using the quantization scale, thereby outputting the DC coefficient 306.

The AC coefficient inverse quantizer 120 carries out the

inverse quantization of the AC coefficient data, and outputs an AC coefficient 307. The DC coefficient 306 (which is present only in the intra coded mode) passing through the inverse quantization and the AC coefficient 307 are transferred to an inverse DCT section 115 as a DCT coefficient 308 which undergoes the inverse DCT, and is output as a decoded prediction error signal 309. An adder 116 adds the decoded prediction error signal 309 to the prediction texture data 9 obtained by the motion compensator 8, and outputs the sum as the decoded texture data 11. The addition of the prediction texture data 9 is not performed in the intra coded mode.

When the coded bit stream 1 includes the H.263 compatible identification information 33 multiplexed therein, it may sometimes include an end-of-sequence code (EOS) 227 indicating the end of the sequence, which is multiplexed therein as shown in Fig. 2(a). The end-of-sequence code 227 is detected by the picture start code detector 41 so that the decoding operation is completed on the detection of the end-of-sequence code 227.

As described above, the present embodiment 1 is configured such that it receives the MPEG-4 compatible H.263 coded bit stream 203 consisting of the H.263 coded bit stream 201 into which the VO start code 231, VOL start code, VO identification number 232 and H.263 compatible identification information 226 are multiplexed, and decodes these information items. This offers an advantage of being able to implement an image decoding apparatus having compatibility between the H.263 and MPEG-4.

## EMBODIMENT 2

Fig. 17 is a block diagram showing a configuration of an image coding apparatus in the embodiment 2, which generates a

coded bit stream decodable by the image decoding apparatus described in the embodiment 1. In this figure, the reference numeral 121 designates an input image signal; 122 designates an H.263 encoder; 123 designates an H.263 coded bit stream; 124 designates an MPEG-4 compatible flag; 125 designates a header information multiplexer; and 126 designates an MPEG-4 compatible H.263 coded bit stream.

Next, the operation will be described.

First, the H.263 encoder 122 encodes the input image signal 121 according to the H.263 syntax, and generates the H.263 coded bit stream 123. Subsequently, the header information multiplexer 125, receiving the MPEG-4 compatible flag 124 indicative of generating the bit stream decodable by an MPEG-4 based decoder, multiplexes, before the picture header of the H.263 bit stream, the VO start code 231, VO identification number 232, VOL start code 233 and H.263 compatible identification information (a flag of "0" or "1" indicative of the H.263 based bit stream) 226, which are needed for implementing decoding by the image decoding apparatus as described in the embodiment 1. Thus, the contents of the MPEG-4 compatible H.263 coded bit stream 126 passing through the multiplexing become the bit stream as shown in Fig. 2(a) described in connection with the embodiment 1.

When the H.263 coding apparatus 127 is carrying out real time communication with an MPEG-4 decoding apparatus 128 as shown in Fig. 18, the MPEG-4 decoding apparatus 128 can send the MPEG-4 compatible flag 124 to the H.263 coding apparatus 127, and in response to the reception of the MPEG-4 compatible flag 124, the H.263 coding apparatus 127 can multiplex into the H.263 bit stream 123 the VO start code 213, VO identification number 232,

VOL start code 233 and H.263 compatible identification information 226, which are required for achieving decoding by the image decoding apparatus as described in the embodiment 1.

As described above, the present embodiment 2 multiplexes the VO start code 231, VO identification number 232, VOL start code 233 and H.263 compatible identification information 226 into the H.263 coded bit stream 123. This offers an advantage of being able to implement an image coding apparatus capable of generating a coded bit stream decodable by an MPEG-4 compatible image decoding apparatus.

### EMBODIMENT 3

Fig. 19 is a diagram showing a structure of an MPEG-4 compatible H.263 coded bit stream 205 in the present embodiment 3. It includes in addition to the conventional H.263 coded bit stream 201 as shown in Fig. 1(a) a VO start code 231, a VO identification number 232 and an H.263 start code 228. The H.263 start code 228 has the functions of both the VOL start code 233 and H.263 compatible identification information 226 which are multiplexed in the embodiment 1.

The MPEG-4 coded bit stream 202 is identical to the conventional one as shown in Fig. 1(b).

The image decoding apparatus in the present embodiment differs from the image decoding apparatus described in the embodiment 1 only in the header information analyzer 21. Fig. 20 is a block diagram showing a configuration of the header information analyzer 21 in the embodiment 3. In this figure, the reference numeral 131 designates an H.263 start code/VOL start code detector; and 132 designates a coding scheme decision section. The VO start code detector 30, H.263 compatible

identification information 33, switching section 34, H.263 picture header information analyzer 35, H.263 GOB header information analyzer 36, VOL header information decoder 37 and VOP header information analyzer 38 are the same as their counterparts as shown in Fig. 5 of the embodiment 1.

Next, the operation will be described.

In response to the detection of the VO start code 231 by the VO start code detector 30, the following decoding operation is started. First, as for the MPEG-4 compatible H.263 coded bit stream 205, the H.263 start code/VOL start code detector 131 detects the H.263 start code, while as for the MPEG-4 coded bit stream 202, it detects the VOL start code 233.

In the MPEG-4, the start code in each layer consists of a code (0000 0000 0000 0000 0000 0001) common to all the start codes, followed by a fixed length (5-bit) start code unique to the layer. The common start code is surely detected as the start code in the bit stream. Thus, the H.263 start code 228 also has a structure consisting of the common start code followed by the fixed length (5-bit) code enabling it to be identified as the H.263 coded bit stream.

When the start code detected is the H.263 start code 228, the coding scheme decision section 132 places the H.263 compatible identification information 33 at the H.263. In contrast, when the start code is the VOL start code 233, it places the H.263 compatible identification information 33 at the MPEG-4. The subsequent operation is the same as that of the embodiment 1.

As described above, the present embodiment 3 is configured such that it receives the MPEG-4 compatible H.263 coded bit stream 205 consisting of the H.263 coded bit stream 201 into

which the VO start code 231, VO identification number 232 and H.263 start code 228 are multiplexed, and decodes these information items. This offers an advantage of being able to implement an image decoding apparatus having compatibility  
 5 between the H.263 and MPEG-4.

#### EMBODIMENT 4

The present embodiment 4 is an image coding apparatus for generating a bit stream decodable by the image decoding apparatus  
 10 described in the embodiment 3, and has the same configuration as that shown in Fig. 17 of the embodiment 2.

Next, the operation will be described.

First, the H.263 encoder 122 encodes the input image signal 121 according to the H.263 syntax, thereby generating the H.263  
 15 coded bit stream 123. Subsequently, receiving the MPEG-4 compatible flag 124, the header information multiplexer 125 multiplexes, before the picture header of the H.263 bit stream, the VO start code 231, VO identification number 232 and H.263 start code 228, which are needed for implementing decoding by  
 20 the image decoding apparatus as described in the embodiment 3. Thus, the contents of the MPEG-4 compatible H.263 coded bit stream 126 passing through the multiplexing become equivalent to those of the bit stream as shown in Fig. 19 described in connection with the embodiment 3.

25 Incidentally, the MPEG-4 compatible flag 124 can be transferred from the MPEG-4 decoding apparatus 128 as described in connection with Fig. 18 of the embodiment 2.

As described above, the present embodiment 4 multiplexes the VO start code 231, VO identification number 232 and H.263  
 30 start code 228 into the H.263 bit stream 201. This offers an

advantage of being able to implement an image coding apparatus capable of generating a coded bit stream decodable by the MPEG-4 compatible image decoding apparatus.

## 5 EMBODIMENT 5

The present embodiment 5 comprises a multiplexer for multiplexing the header information for implementing the MPEG-4 compatibility on a network, for example, independently of a coding apparatus. Fig. 21 is a diagram showing an image  
10 communications system in the present embodiment 5. In this figure, the reference numeral 141 designates an H.263 coding apparatus; 142 designates an MPEG-4 decoding apparatus; and 143 designates a coded bit stream converting apparatus. The H.263 coding apparatus 141, MPEG-4 decoding apparatus 142 and coded  
15 bit stream converting apparatus 143 are connected to a network.

Next, the operation will be described.

Receiving an MPEG-4 compatible flag 147 requesting for an MPEG-4 compatible H.263 coded bit stream 148 from the MPEG-4 decoding apparatus 142 or from a user, the coded bit stream  
20 converting apparatus 143 receives an H.263 coded bit stream 146 from the H.263 coding apparatus 141, multiplexes into the H.263 coded bit stream 146 the header information needed by the MPEG-4 decoding apparatus for carrying out decoding as described in the embodiment 2 or 4, and transmits the multiplexed data to  
25 the MPEG-4 decoding apparatus 142.

As described above, the present embodiment 5 comprises the coded bit stream converting apparatus 143 in the network. This offers an advantage of being able to implement an image communications system having compatibility between the H.263  
30 and MPEG-4.



## EMBODIMENT 6

Fig. 22 is a diagram showing an image communications system in the present embodiment 6. In this figure, the reference numeral 141 designates the H.263 coding apparatus; 143 designates the coded bit stream converting apparatus; 144 designates a server; and 145 designates an MPEG-4 decoding apparatus built-in type browser, which are connected to a network.

Next, the operation will be described.

When the MPEG-4 decoding apparatus built-in type browser 145 makes an access to the H.263 coded bit stream 146 transmitted on the network, it transmits to the server 144 the MPEG-4 compatible flag 147 indicative of decoding by the MPEG-4 decoding apparatus. Receiving the MPEG-4 compatible flag 147, the server 144 transmits the H.263 coded bit stream 146 to the coded bit stream converting apparatus 143.

The coded bit stream converting apparatus 143 generates the MPEG-4 compatible H.263 coded bit stream 148 decodable by the MPEG-4 decoding apparatus by adding header information to the received H.263 bit stream 146 as described in the embodiment 2 or 4, and transmits it to the MPEG-4 decoding apparatus built-in type browser 145. Receiving the MPEG-4 compatible H.263 coded bit stream 148, the MPEG-4 decoding apparatus built-in type browser 145 can decode the H.263 coded bit stream 146 to display images.

The MPEG-4 decoding apparatus built-in type browser 145 itself can also incorporate the coded bit stream converting apparatus 143. In this case, the MPEG-4 decoding apparatus built-in type browser 145 receives the H.263 coded bit stream

146 from the server 144, and converts the MPEG-4 compatible H.263 coded bit stream 148, so that the built-in MPEG-4 decoding apparatus can decode it to display images.

As described above, the present embodiment 6 comprises on the network the coded bit stream converting apparatus and the server. This offers an advantage of being able to implement an image communications system having compatibility between the H.263 and MPEG-4.

## 10 EMBODIMENT 7

The image decoding apparatuses as described in the foregoing embodiments 1 and 3 can distinguish the H.263 bit stream from the MPEG-4 bit stream. However, they cannot receive the H.263 bit stream as it is because the header information for making it MPEG-4 compatible must be multiplexed into the initial position of the H.263 bit stream generated by the H.263 coding apparatus. The embodiment 7 is an image decoding apparatus capable of receiving the H.263 bit stream without any change.

20 Fig. 23 is a block diagram showing a configuration of the header information analyzer 21 in the present embodiment 7. In this figure, the reference numeral 151 designates an H.263 picture start code detector for detecting an H.263 picture start code 221 multiplexed into the H.263 coded bit stream; 152 designates a coding scheme decision section; and 153 designates an H.263 picture header information analyzer for setting the VOL header information and VOP header information in response to the picture header information 222 multiplexed into the H.263 coded bit stream. The remaining VO start code detector 30, H.263 compatible identification information 33, switching section 34,

H.263 GOB header information analyzer 36, VOL header information decoder 37 and VOP header information analyzer 38 correspond to those of the embodiment 1. The components other than the header information analyzer 21 are equivalent to those of the image decoding apparatus of the embodiment 1.

Next, the operation will be described.

The H.263 picture start code detector 151 always monitors the start and end of the coded bit stream as shown in Fig. 24(a) and 24(b). It monitors, as a continuous coded bit stream, from the picture start code 221 to the macroblock data 225 as for the H.263 coded bit stream 201, while from the VO start code 231 to the macroblock data 239 with the MPEG-4 coded bit stream 202.

Receiving the H.263 coded bit stream 201, the H.263 picture start code detector 151 detects the picture start code 221, and supplies the result to the coding scheme decision section 152. The coding scheme decision section 152 makes a decision from the picture start code 221 that the received coded bit stream is the H.263 coded bit stream 201, and places the H.263 compatible identification information 33 at the H.263. In contrast, when the VO start code detector 30 detects the VO start code 231, the coding scheme decision section 152 makes a decision that the received coded bit stream is the MPEG-4 coded bit stream 202, and places the H.263 compatible identification information 33 at the MPEG-4.

As for the H.263 coded bit stream 201, the switching section 34 supplies it to the H.263 picture header information analyzer 153. The H.263 picture header information analyzer 153 decodes the picture header information 222 multiplexed into the H.263 coded bit stream 201, and sets the VOL header information and

VOP header information as in the embodiment 1. The subsequent operation is the same as that of the embodiment 1.

On the other hand, as for the MPEG-4 coded bit stream 202, the switching section 34 supplies it to the VOL header

5 information decoder 37. The subsequent operation is the same as that of the embodiment 1.

As described above, the present embodiment 7 decides that the bit stream is the H.263 coded bit stream 201 when detecting the picture start code 221, and sets the VOL header information and VOP header information. This offers an advantage of being  
10 able to implement an image decoding apparatus having compatibility between the H.263 and MPEG-4.

#### EMBODIMENT 8

15 The present embodiment 8 relates to a coded bit stream converting apparatus for converting the H.263 coded bit stream 201 as shown in Fig. 1(a) to the MPEG-4 coded bit stream 202 as shown in Fig. 1(b).

Fig. 25 is a block diagram showing the coded bit stream  
20 converting apparatus in the embodiment 8. In this figure, the reference numeral 161 designates a syntax analyzer for splitting the H.263 coded bit stream 201 into a picture header information code word 401, GOB header information code word 402 and macroblock data code word 403; 162 designates a picture header  
25 information decoder for decoding the picture header information code word 401; 163 designates a GOB header information analyzer/converter for decoding the GOB header information code word 402; 164 designates an MPEG-4 header information setting section for setting the VOL header information 234 and VOP header  
30 information 236; and 165 designates a multiplexer for producing

the MPEG-4 coded bit stream 202.

Next, the operation will be described.

The syntax analyzer 161, detecting the picture start code 221 in the H.263 coded bit stream 201, splits the subsequent coded bit stream into the picture header information code word 401, GOB header information code word 402 and macroblock data code word 403, and supplies them to the picture header information decoder 162, GOB header information analyzer/converter 163 and multiplexer 165. The GOB header information code word 402 is not necessarily multiplexed into the H.263 coded bit stream 201, but is multiplexed as long as the GOB start code 223 is detected. When the GOB start code 223 is detected, GOB header detection information 404 is supplied to the MPEG-4 header information setting section 164. The picture header information decoder 162 decodes the picture header information code word 401 as in the embodiment 1, and supplies the MPEG-4 header information setting section 164 with picture header information 405 decoded.

In response to the decoded picture header information 405, the MPEG-4 header information setting section 164 sets the VOL header information 234 and VOP header information 236 as in the embodiment 1. As with the header information not referred to in the embodiment 1, any value disclosed in the ISO/IEC JTC1/SC29/WG11 MPEG-4 Video VM8.0 can be set. When the MPEG-4 header information setting section 164 receives the GOB header detection information 405, it enables the error resistant coding instruction mode.

As described in the embodiment 1, the decoding procedure of the macroblock data of the H.263 differs from that of the MPEG-4. Accordingly, the decoding side must change the decoding

method in response to switching information. For this reason, the following switching information must be set in the VOL header.

(1) AC coefficient VLC table switching information.

5           Information for switching VLD tables used for carrying out the variable length decoding of the AC coefficient data on the decoding side, when the coding side uses different VLC tables for carrying out the variable length coding of the AC coefficient data as described in the embodiment 1.

10       (2) Esc Coding switching information.

          Information for switching decoding schemes on the decoding side, when the coding side uses different coding schemes in the case where the AC coefficient data is not present in the VLC tables when carrying out the variable length coding of the AC  
15       coefficient data as described in the embodiment 1.

(3) Intra DC coefficient inverse quantization switching information.

          Information for switching the inverse quantization method of the DC coefficients, when the coding side employs different  
20       intra DC coefficient quantization methods as described in the embodiment 1.

The switching information items of the foregoing (1)-(3) can be integrally set as information for switching between the technique employed by the H.263 and other techniques.

25           The MPEG-4 header information set by the MPEG-4 header information setting section 164 undergoes the variable length coding, and is supplied to the multiplexer 165 as MPEG-4 header information code word 406.

          The GOB header information analyzer/converter 163 decodes  
30       the GOB header information code word 402 as in the embodiment

1, and converts the GOB header information 224 into the resynchronization information 238 in the MPEG-4 representation form.

The MPEG-4 resynchronization information 238 is used as an error resistance reinforcer, and is multiplexed when the error resistant coding indication information of the VOL header information 236 is valid. When decoding the resynchronization information 238, the decoding side establishes the resynchronization with the coded bit stream, and resets the prediction vector and quantization step size used for decoding the macroblock. In the H.263, the prediction vector and the quantization step size are reestablished when the GOB header information 224 is decoded. Therefore, converting the GOB header information 224 using the resynchronization information 238 enables the GOB header information 224 to be converted into the MPEG-4 representation form.

Fig. 26 is a diagram showing a structure of the GOB header information 224 and the resynchronization information 238. A macroblock number 271 in the resynchronization information 238 is the number indicating the position of the macroblock in the VOP. It can be obtained by calculating the position of the macroblock corresponding to the received H.263 macroblock data in the picture. Since it corresponds to the first macroblock in the GOB, it can be calculated from the GOB number. A quantization scale 272 is obtained by setting the GOB quantization step size. A header expansion instruction code 273 is "1" when a time reference 274 and a VOP elapsed time 275 are to be multiplexed. These items of the information are used for representing the individual VOPs. The time reference 274 and the VOP elapsed time 275 can be set as needed when setting the

header expansion instruction code 273 at "1". The resynchronization information 238 undergoes the variable length coding, so that the multiplexer 165 is supplied with a resynchronization information code word 407 that includes a  
 5 resynchronization instruction code, that is, a fixed length unique code indicating that the resynchronization information 238 is multiplexed.

The multiplexer 165 multiplexes the MPEG-4 header information code word 406, resynchronization information code  
 10 word 407 and macroblock data code word 403 into the coded bit stream, and supplies it to the MPEG-4 coded bit stream 202.

Although the resynchronization information is assumed to be multiplexed when the error resistant coding indication information of the VOL header information 234 is valid in the  
 15 present embodiment, it can be multiplexed regardless of whether the error resistant coding indication information is valid or invalid.

The syntax analyzer 161 completes its analysis when it detects the end-of-sequence code 227 in the case where the  
 20 end-of-sequence code 227 is added after the macroblock data 225 in the H.263 coded bit stream 201.

As described above, the present embodiment converts the H.263 coded bit stream 201 into the MPEG-4 coded bit stream 202. This offers an advantage of being able to decode the H.263 coded  
 25 bit stream by the MPEG-4 image decoding apparatus.

#### EMBODIMENT 9

Although in Fig. 23 of the embodiment 7 when the H.263 picture start code detector 151 detects the picture start code  
 30 221, the coding scheme decision section 152 identifies the H.263



coded bit stream 201, and the H.263 picture header information analyzer 153 sets the VOL header information and VOP header information, the present embodiment switches the operation of the macroblock layer syntax analyzer 22 in response to the picture header information 222 decoded by the H.263 picture header information decoder 42 as shown in Fig. 6, which is included in the H.263 picture header information analyzer 153. This can obviate the MPEG-4 header information setting section 43. In addition, when the GOB start code detector 61 as shown in Fig. 8 of the embodiment 7 detects the GOB start code 223 in the H.263 coded bit stream 201, the GOB header information decoder 62 decodes the GOB header information 224, and the MPEG-4 header information update section 63 resets the VOP quantization step size included in the VOP header information 236. However, to decode the H.263 coded bit stream 201, it is enough for the present embodiment to reset the picture quantization step size 304 included in the picture header information 222 in order to decode the macroblock data using the picture header information 222.

Next, the operation of the macroblock layer syntax analyzer 22 will be described when decoding the macroblock data in response to the picture header information 222 decoded by the H.263 picture header information decoder 42.

Since the present embodiment differs in the operation of the switching sections 81, 83, 88 and 95, in the operation of the adder 94 and in the operation of the motion vector decoder 97 in the macroblock layer syntax analyzer as shown in Fig. 12, and differs in the operation of the switching section 102 in the block data decoder 98 as shown in Fig. 13, only the different portions will be described.

When the MPEG-4 coded bit stream 202 is decoded, that is, when the MPEG-4 is designated by the H.263 compatible identification information 33 that is set by the coding scheme decision section 152 as shown in Fig. 23, the switching section 81 is switched in response to the geometry information decoded by the VOL header information decoder 37. In contrast with this, when the H.263 coded bit stream 201 is decoded, that is, when the H.263 compatible identification information 33 indicates the H.263, the bit stream 1 is unconditionally supplied to the switching section 83 without passing through the geometry coded data decoder 82.

When the MPEG-4 coded bit stream 202 is decoded, the switching section 83 is switched in response to the VOP prediction type decoded by the VOP header information analyzer 38. On the other hand, when the H.263 coded bit stream 201 is decoded, the switching section 83 is switched in response to the picture coding type 302 decoded by the H.263 picture header information decoder 42. The switching operation itself is the same as that of the embodiment 1, and is carried out in response to whether the picture coding type 302 is intra or not.

When the MPEG-4 coded bit stream 202 is decoded, the switching section 88 is switched in response to the intra AC/DC prediction indication information decoded by the VOL header information decoder 37. When the H.263 coded bit stream 201 is decoded, that is, when the H.263 compatible identification information 33 indicates the H.263, the bit stream 1 is unconditionally supplied to the valid block identification information decoder 90 without passing through the AC prediction indication information decoder 89.

When the MPEG-4 coded bit stream 202 is decoded, the adder

94 adds to the decoded differential quantization step size 254 the VOP quantization step size of the first previous macroblock decoded, and outputs the sum as the quantization step size. In contrast with this, when the H.263 coded bit stream 201 is decoded, it adds to the decoded differential quantization step size 254, the picture quantization step size of the first previous macroblock decoded, and outputs the sum as the quantization step size.

When the MPEG-4 coded bit stream 202 is decoded, the switching section 95 is switched in response to the interlace mode indication information decoded by the VOP header information analyzer 38. When the H.263 coded bit stream 201 is decoded, that is, when the H.263 compatible identification information 33 indicates the H.263, the bit stream 1 is unconditionally supplied to the motion vector decoder 97 without passing through the interlace information decoder 96.

When the MPEG-4 coded bit stream 202 is decoded, the motion vector decoder 97 decodes the motion vector (texture motion data 7) in response to the motion vector search range designation information decoded by the VOP header information analyzer 38. When the H.263 bit stream is decoded, the motion vector decoder 97 decodes the motion vector (texture motion data 7) in response to the motion vector search range defined by the H.263.

When the MPEG-4 coded bit stream 202 is decoded, the switching section 102 in the block data decoder 98 is switched in response to the intra AC/DC prediction mode indication information decoded by the VOL header information decoder 37. When the H.263 coded bit stream 201 is decoded, that is, when the H.263 compatible identification information 33 indicates the H.263, the bit stream 1 is unconditionally supplied to the

DC coefficient fixed length decoder 103. The subsequent operation is the same as that of the embodiment 1.

As described above, the embodiment 9 is configured such that it makes a decision that the bit stream is the H.263 coded  
 5 bit stream 201 when it detects the picture start code 221, decodes the picture header information 222, and decodes the macroblock data in response to the picture header information 222 decoded. This offers an advantage of being able to implement the image  
 10 coding apparatus having compatibility between the H.263 and MPEG-4 without setting the VOL header information and VOP header information.

#### INDUSTRIAL APPLICABILITY

As described above, the image decoding apparatus, image  
 15 coding apparatus, image communications system and coded bit stream converting apparatus in accordance with the present invention can transmit and receive the coded bit stream of a different coding scheme in a simple configuration.

## WHAT IS CLAIMED IS:

1. An image decoding apparatus for decoding a first coded bit stream into which first header information and image coded data encoded in a first coding scheme are multiplexed, or for decoding  
 5 a second coded bit stream into which second header information and image coded data encoded in a second coding scheme are multiplexed, said image decoding apparatus comprising:

coding scheme decision means for making a decision as to whether a received coded bit stream is the first coded bit stream  
 10 or the second coded bit stream in response to the first header information or to the second header information;

decoding means for decoding image coding information on the second coding scheme included in the second header information by receiving the second coded bit stream; and

15 setting means for setting, by receiving the first coded bit stream, the image coding information on the second coding scheme in response to image coding information on the first coding scheme included in the first header information,

wherein said image decoding apparatus decodes the image  
 20 coded data included in the first coded bit stream or in the second coded bit stream in response to the image coding information set by said setting means or in response to the image coding information decoded by said decoding means.

25 2. The image decoding apparatus according to claim 1, wherein said coding scheme decision means makes the decision in response to coding scheme identification information for identifying the first or second coding scheme, the coding scheme identification information being included in the first header information or  
 30 in the second header information.

3. The image decoding apparatus according to claim 1, wherein said coding scheme decision means makes the decision in response to a start code included in the first header information or in the second header information.

4. The image decoding apparatus according to claim 3, wherein said coding scheme decision means makes the decision in response to an H.263 start code included in the first header information, or to a VOL (Video Object Layer) start code included in the second header information.

5. The image decoding apparatus according to claim 3, wherein said coding scheme decision means makes the decision in response to a picture start code included in the first header information, or to a VO (Video Object) start code included in the second header information.

6. An image coding apparatus comprising:

coding means for generating a first coded bit stream by encoding an image signal in a first coding scheme; and

header information multiplexing means for multiplexing, into the first coded bit stream, header information for ensuring compatibility with a second coded bit stream encoded in a second coding scheme.

7. The image coding apparatus according to claim 6, wherein said header information multiplexing means multiplexes, as the header information for ensuring the compatibility, a start code of the second coding scheme, and coding scheme identification

information indicative of the first coding scheme.

8. An image communications system comprising:

coding means for generating a first coded bit stream by  
5 encoding an image signal in a first coding scheme;

decoding means for decoding a second coded bit stream coded  
in a second coding scheme; and

10 coded bit stream converting means for transmitting the  
first coded bit stream received from said coding means to said  
decoding means, after multiplexing into the first coded bit  
stream header information for ensuring compatibility, which is  
received from said decoding means.

9. A coded bit stream converting apparatus comprising:

15 syntax analyzing means for inputting a first coded bit  
stream generated in a first coding scheme, and for extracting  
first header information in the first coding scheme and image  
coded data;

20 decoding means for decoding the first header information  
extracted;

header information setting means for setting and coding  
second header information in a second coding scheme in response  
to the first header information decoded by said decoding means;  
and

25 multiplexing means for generating a second coded bit stream  
by multiplexing image coded data extracted by said syntax  
analyzing means with the second header information coded by said  
header information setting means.

30 10. An image decoding apparatus for decoding a first coded bit

stream into which first header information and image coded data encoded in a first coding scheme are multiplexed, or for decoding a second coded bit stream into which second header information and image coded data encoded in a second coding scheme are multiplexed, said image decoding apparatus comprising:

coding scheme decision means for making a decision as to whether a received coded bit stream is the first coded bit stream or the second coded bit stream in response to the first header information or to the second header information;

first decoding means for decoding the first header information by receiving the first coded bit stream; and

second decoding means for decoding image coding information on the second coding scheme included in the second header information by receiving the second coded bit stream,

wherein said image decoding apparatus decodes, when the coded bit stream received is the first coded bit stream, the image coded data included in the first coded bit stream in response to the first header information decoded by said first decoding means, and decodes, when the coded bit stream received is the second coded bit stream, the image coded data included in the second coded bit stream in response to the image coding information decoded by said second decoding means.



## ABSTRACT OF THE DISCLOSURE

An image decoding apparatus is capable of decoding coded bit streams with different coding schemes. The image decoding apparatus includes a coding scheme decision section for deciding  
5 a coding scheme from coding scheme identification information multiplexed into a coded bit stream, a setting unit for setting header information on a second coding scheme in accordance with header information in a first coding scheme, and a decoder for decoding image coded data in the first coding scheme in response  
10 to the header information on the second coding scheme, which is set.

FIG.1(a)

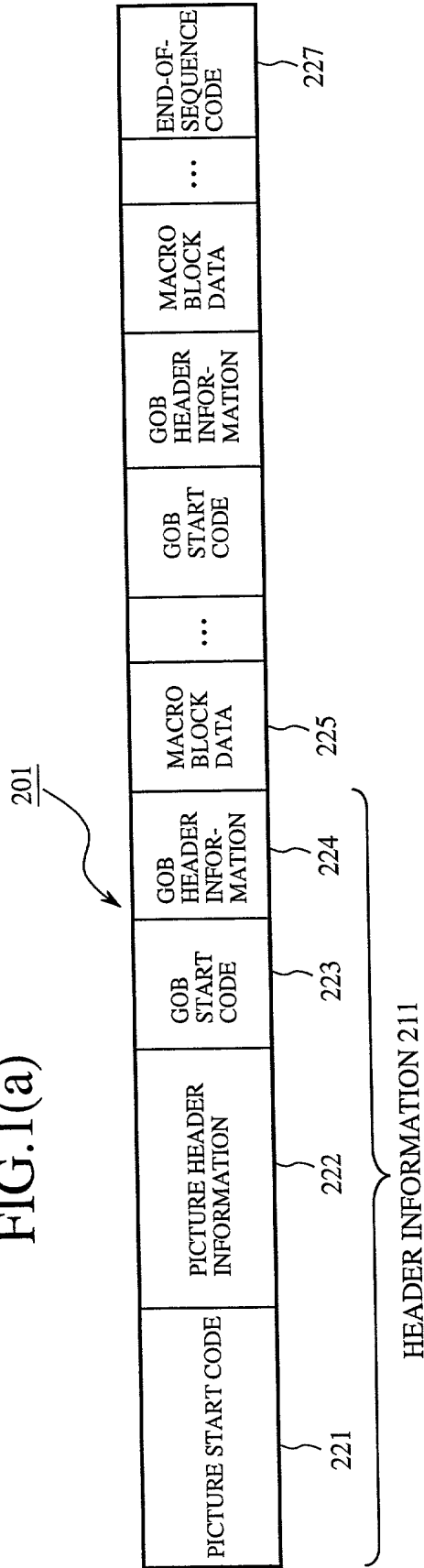


FIG.1(b)

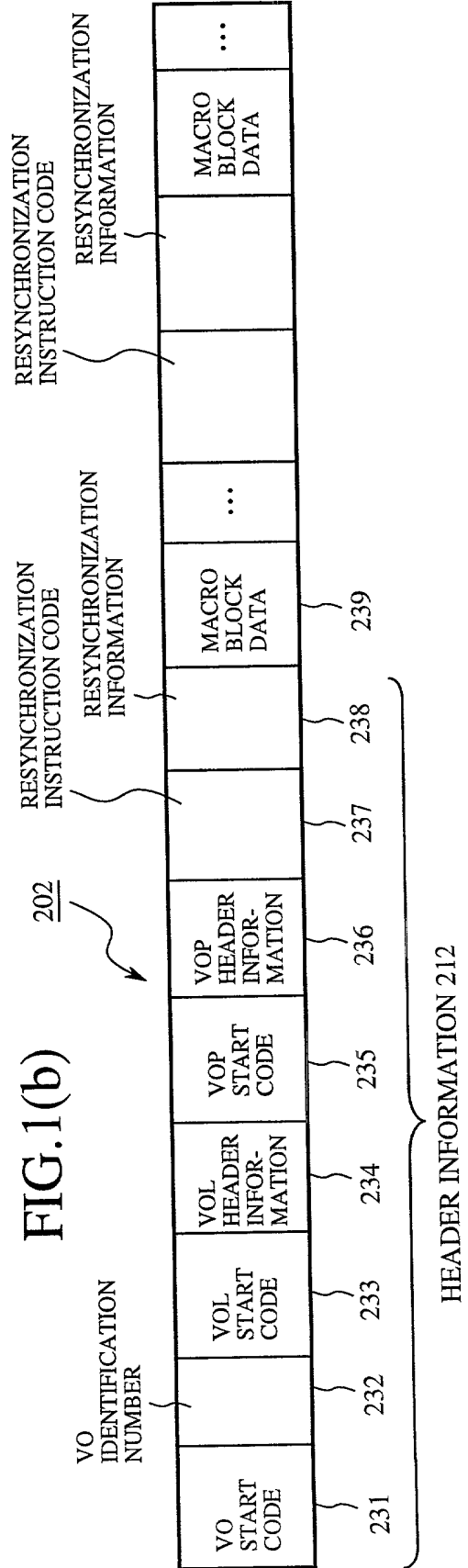


FIG.2(a)

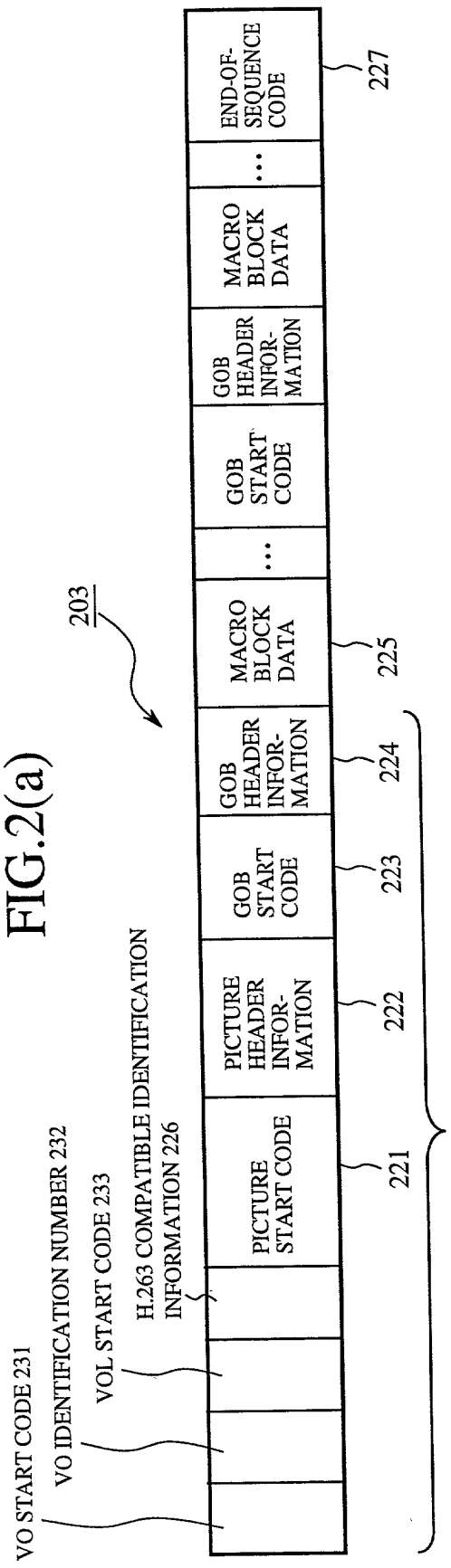
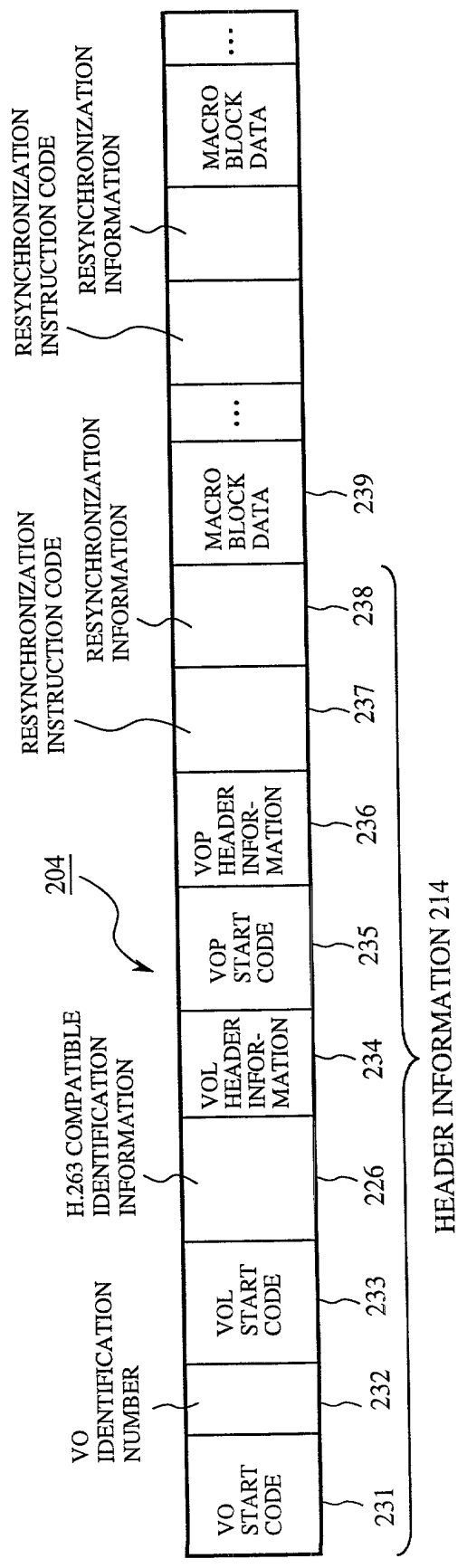


FIG.2(b)



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FIG.3

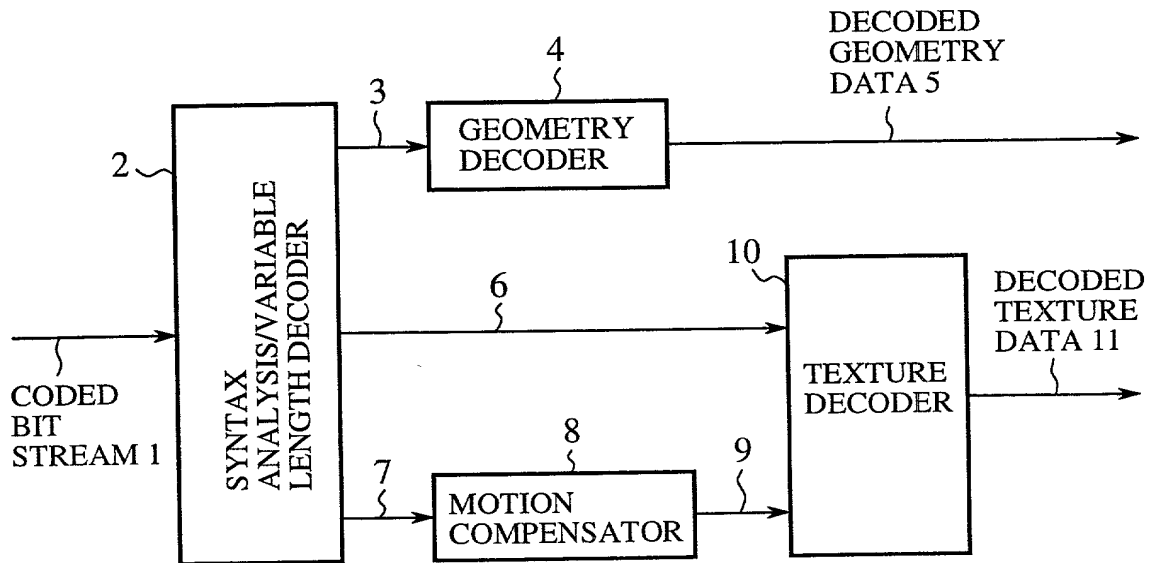


FIG.4

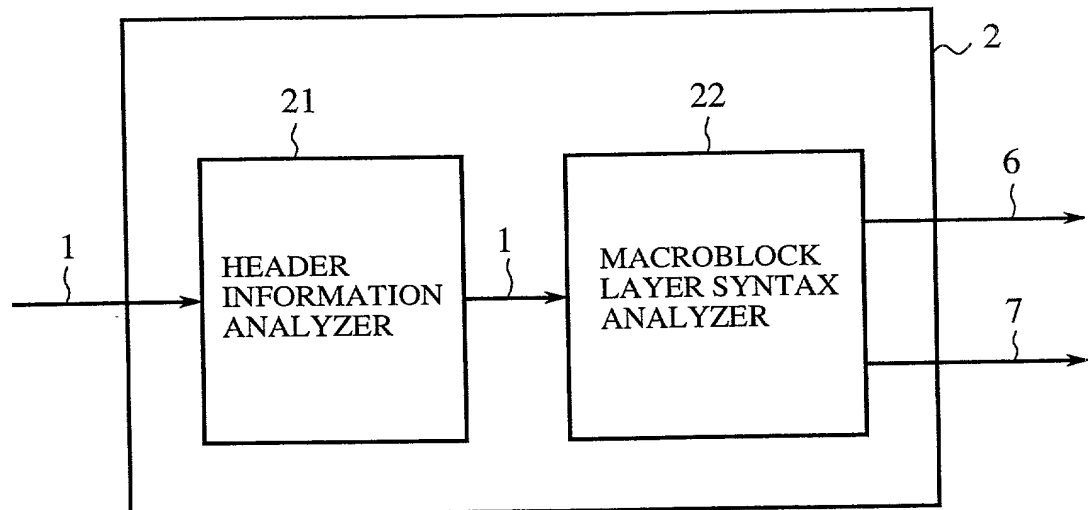


FIG. 5

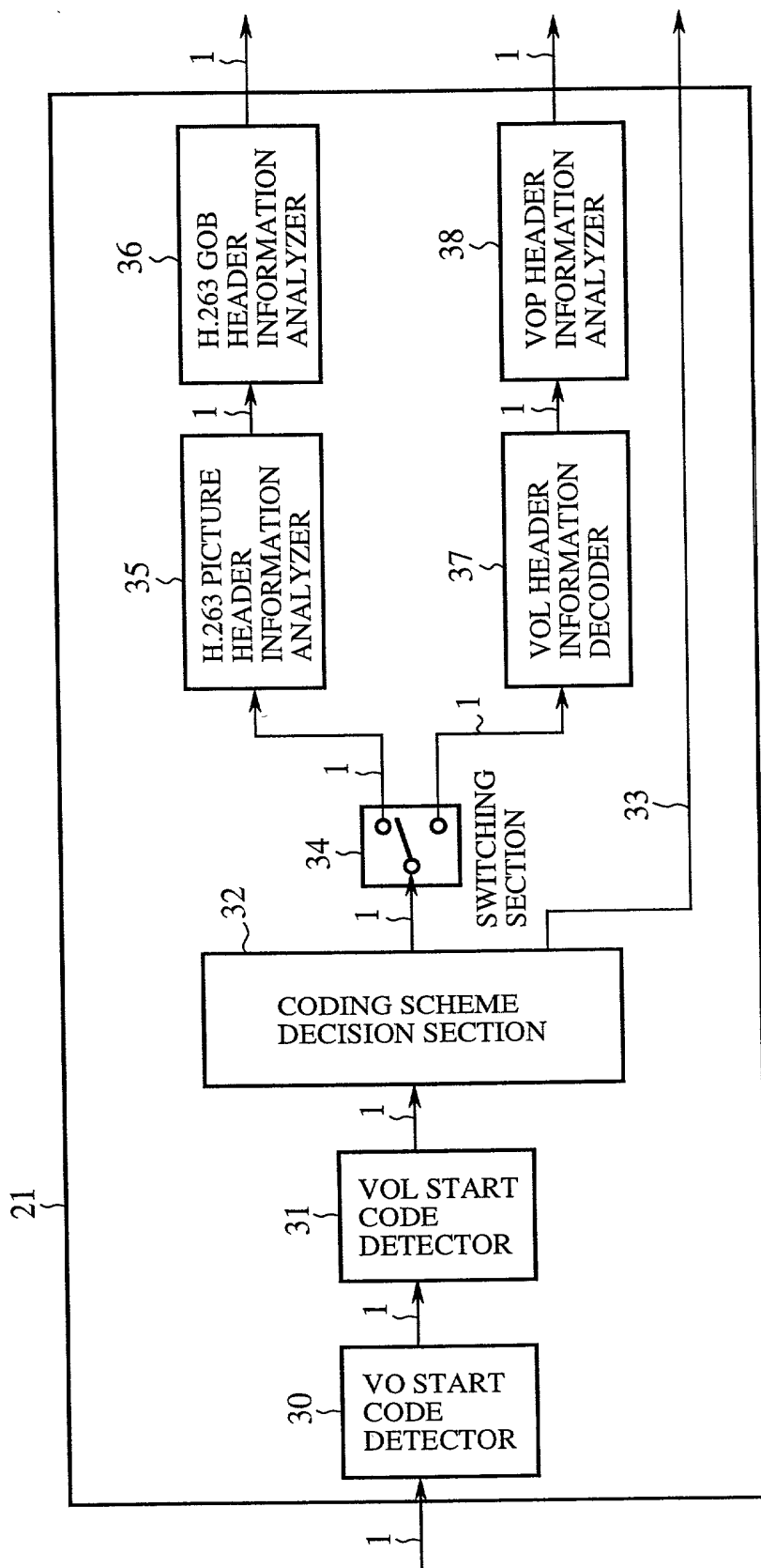


FIG.6

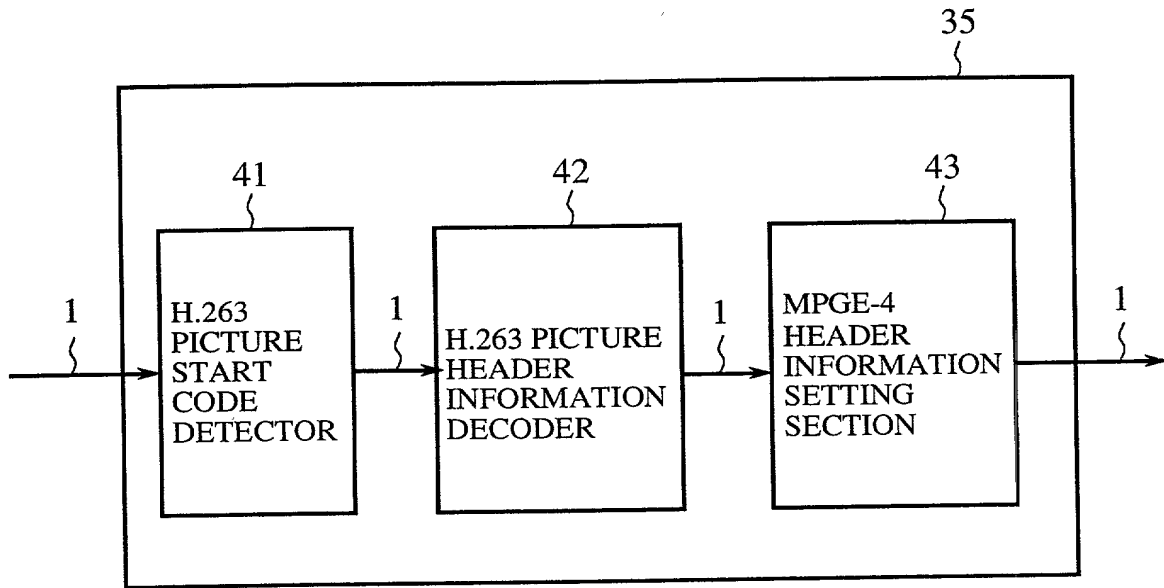


FIG.8

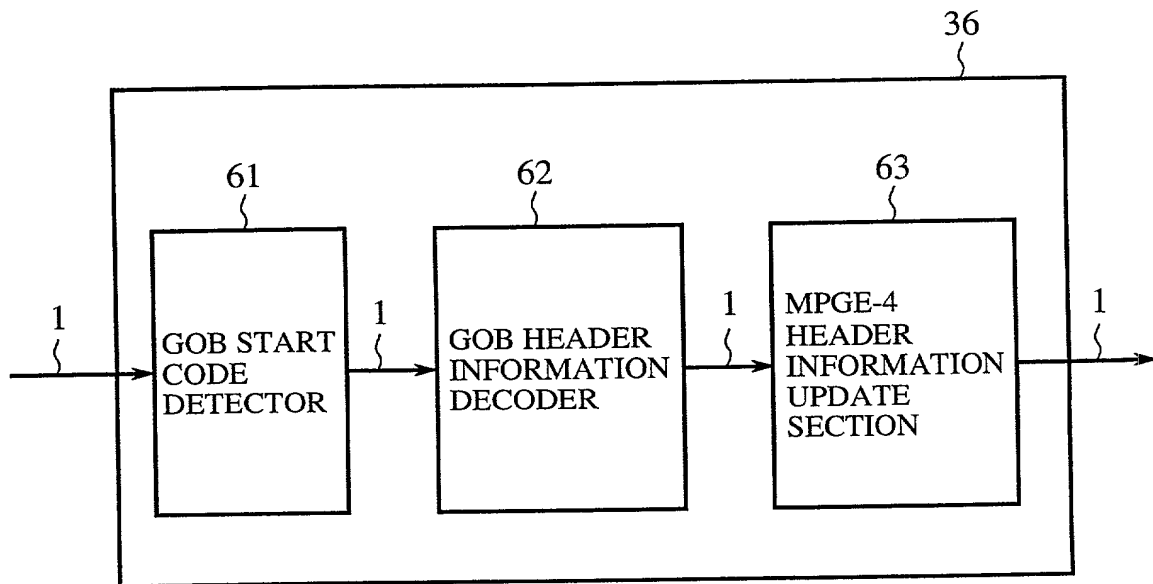


FIG.7

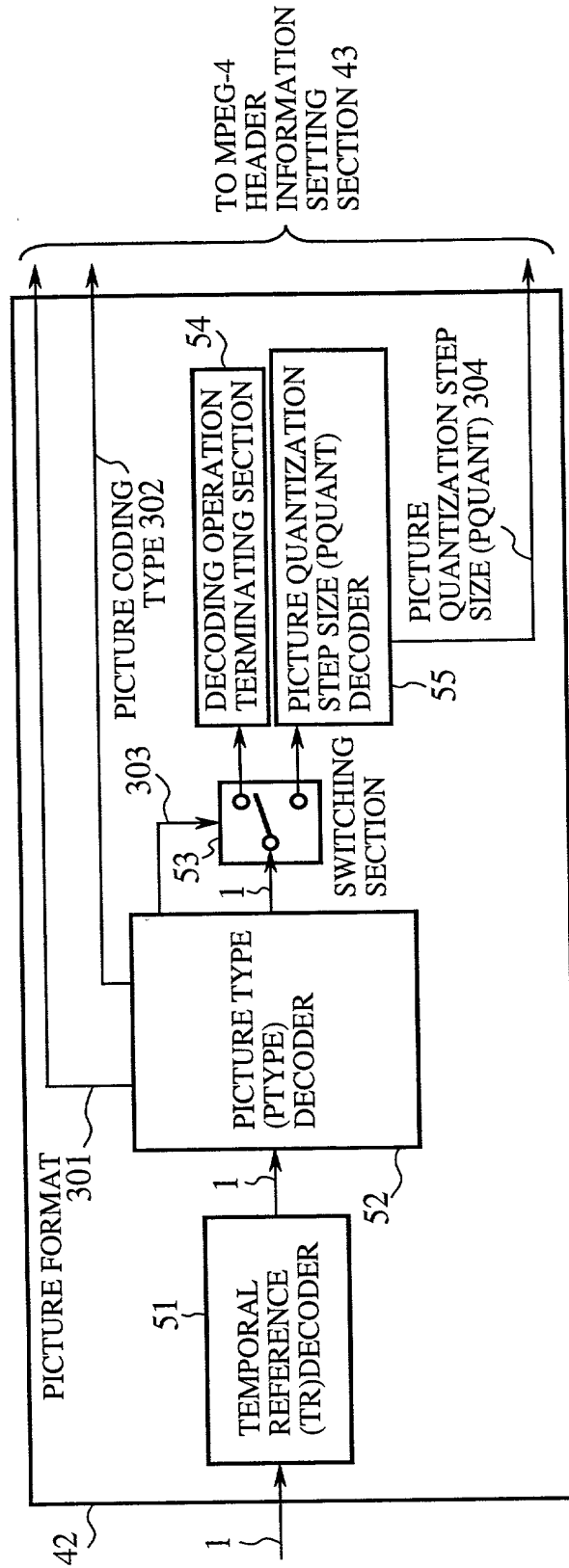
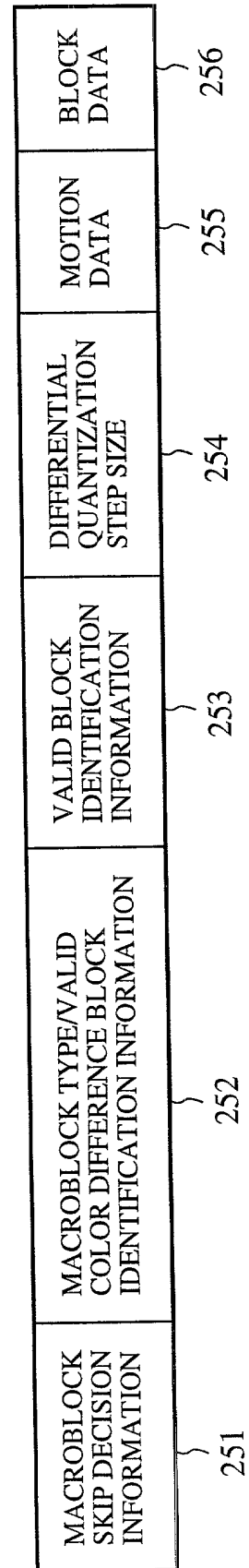


FIG.11



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FIG.9

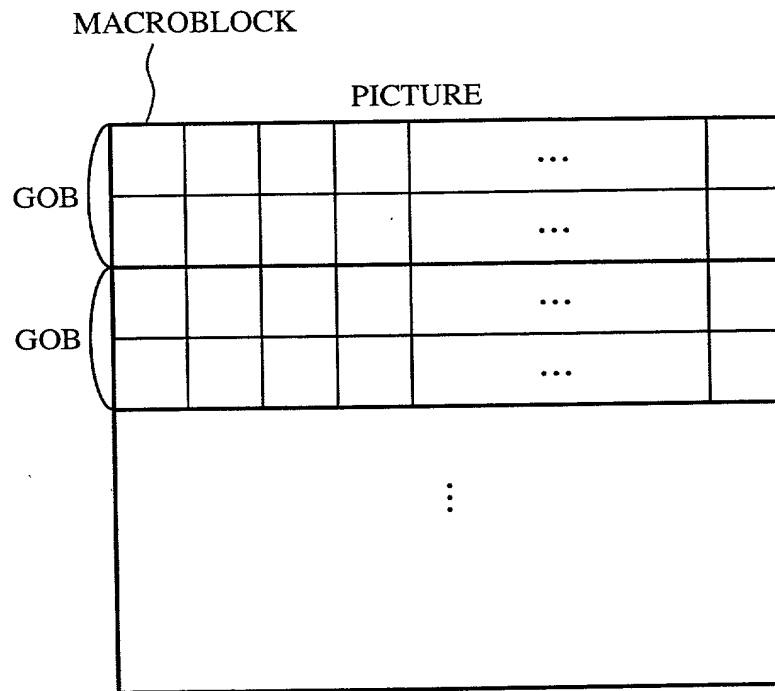


FIG.10

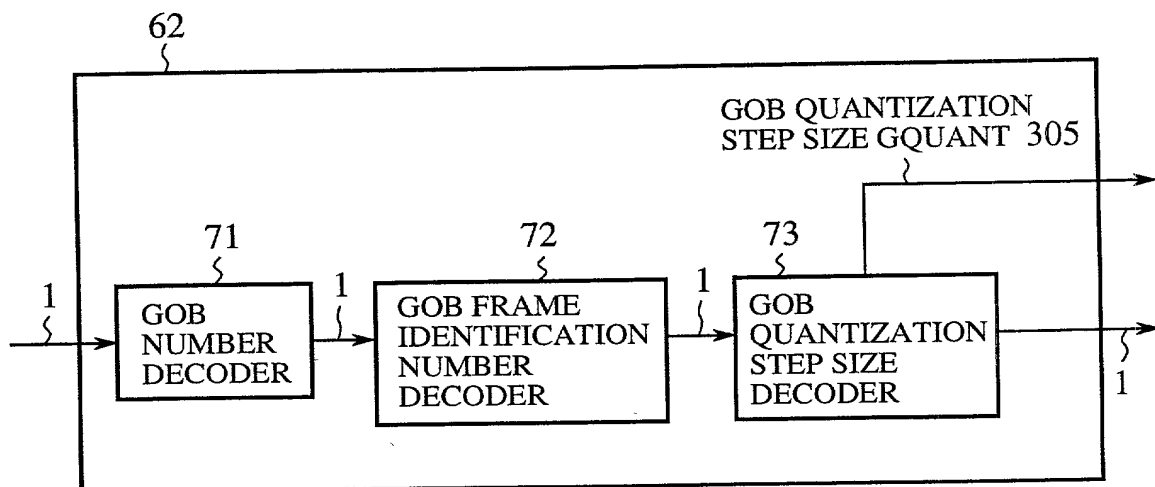
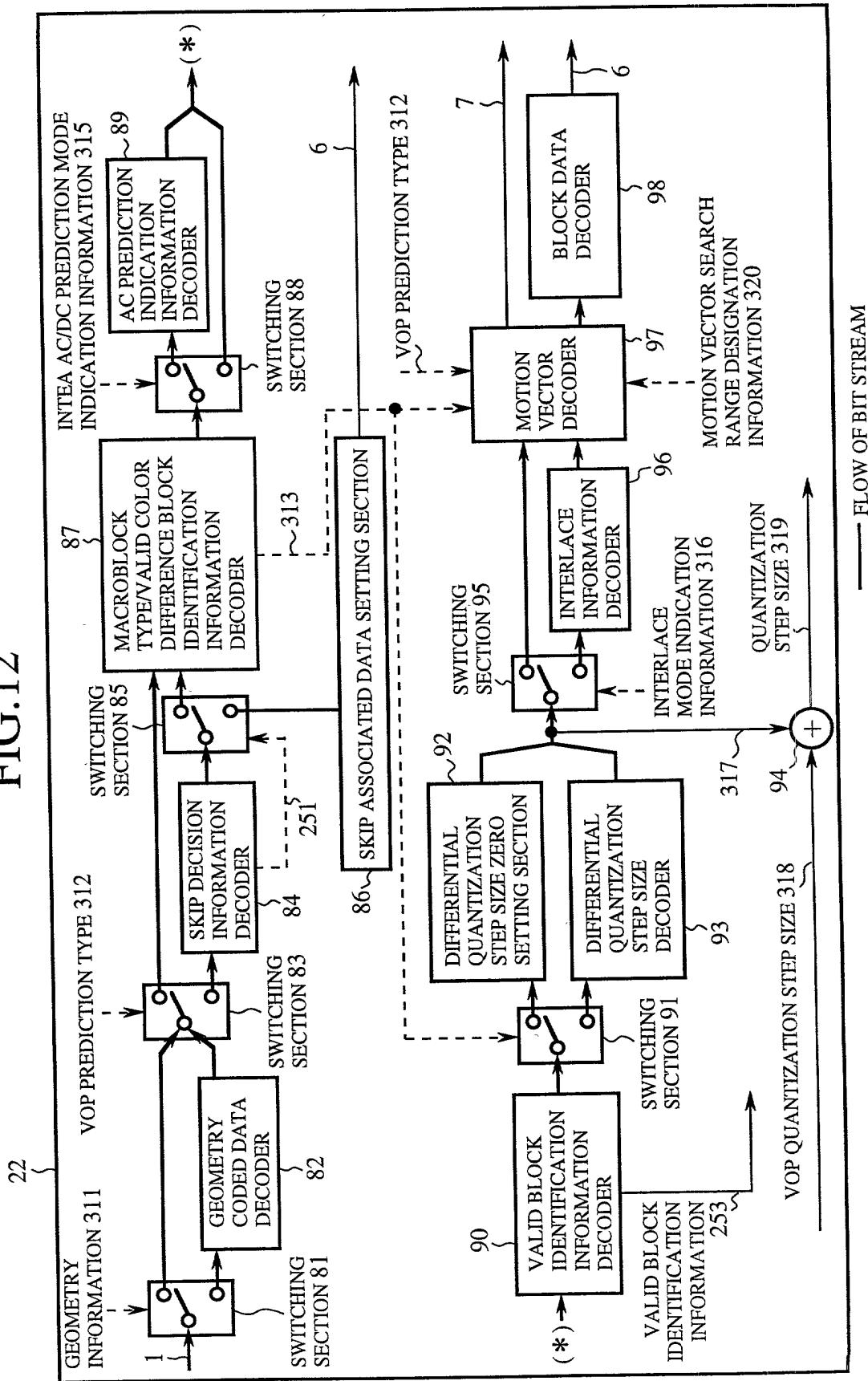




FIG. 12



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FIG.13

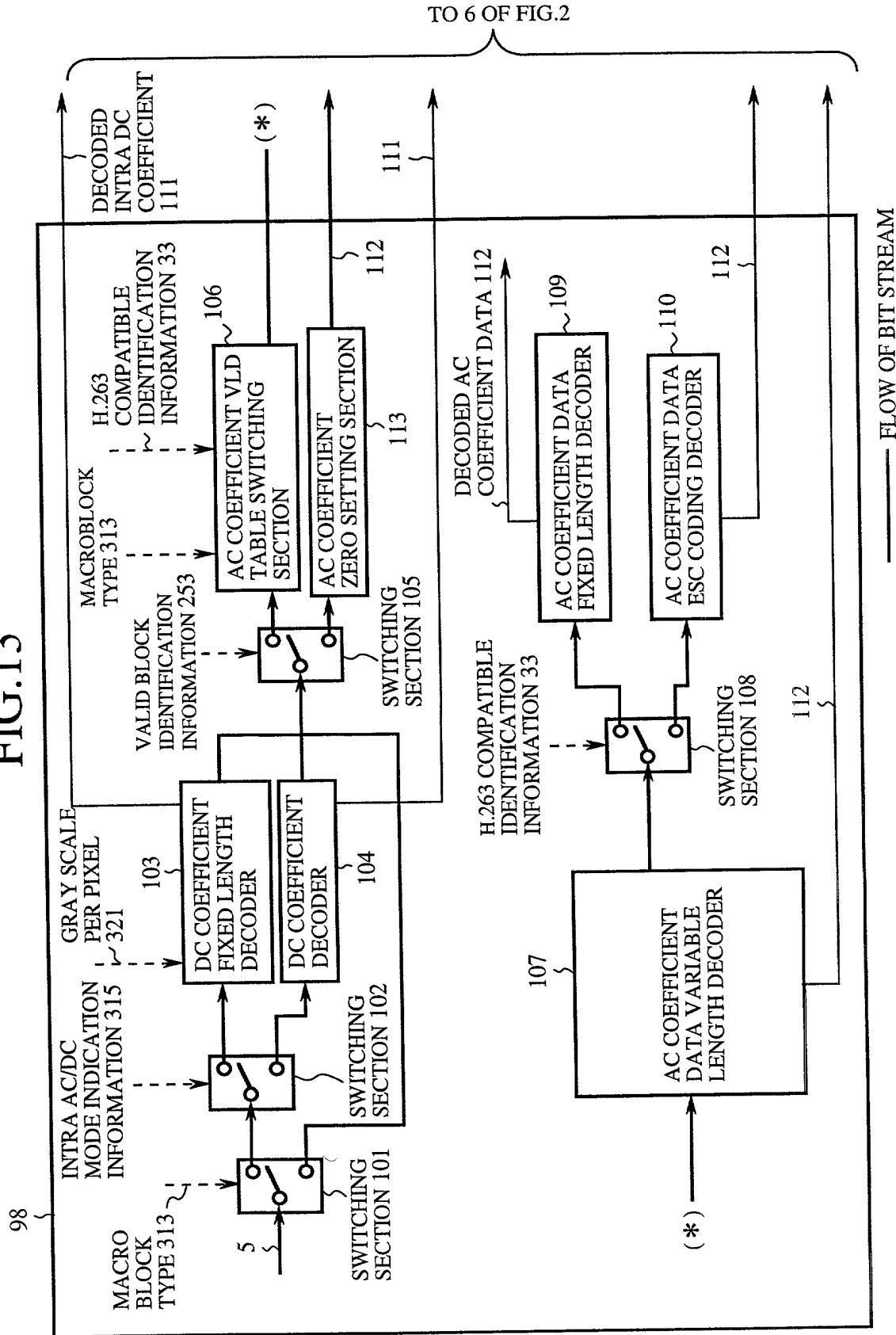
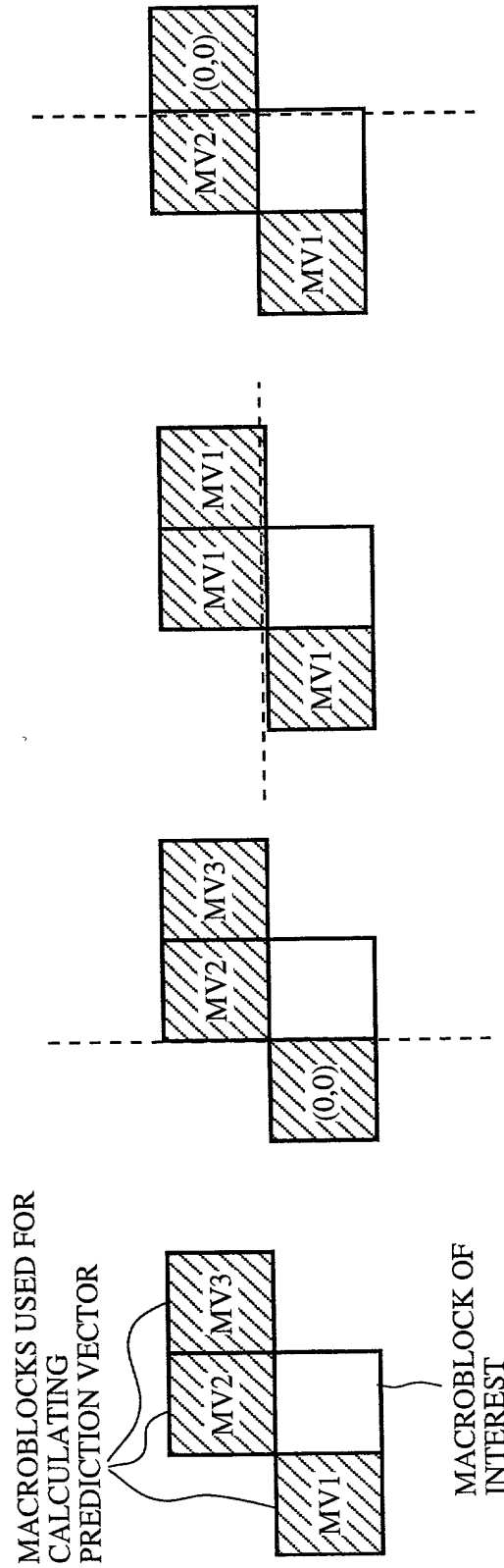


FIG.14(d)

FIG.14(c)

FIG.14(b)

FIG.14(a)



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FIG.15

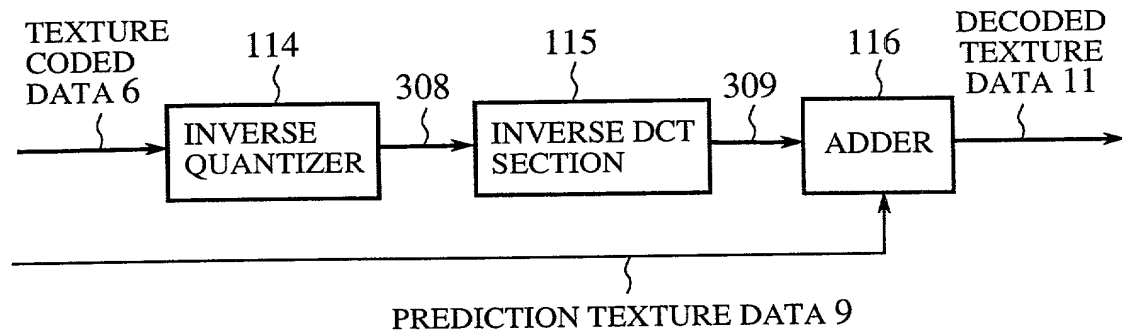


FIG.17

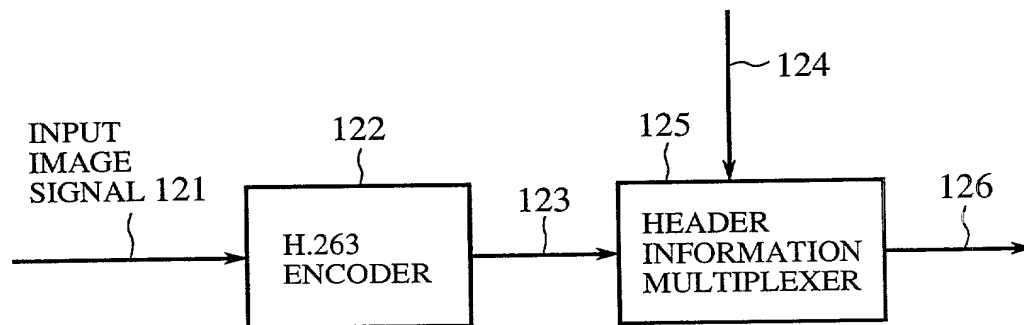
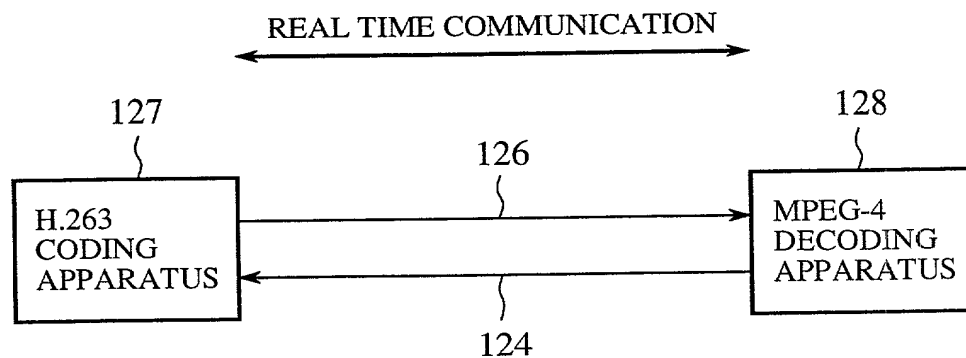


FIG.18



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FIG.16

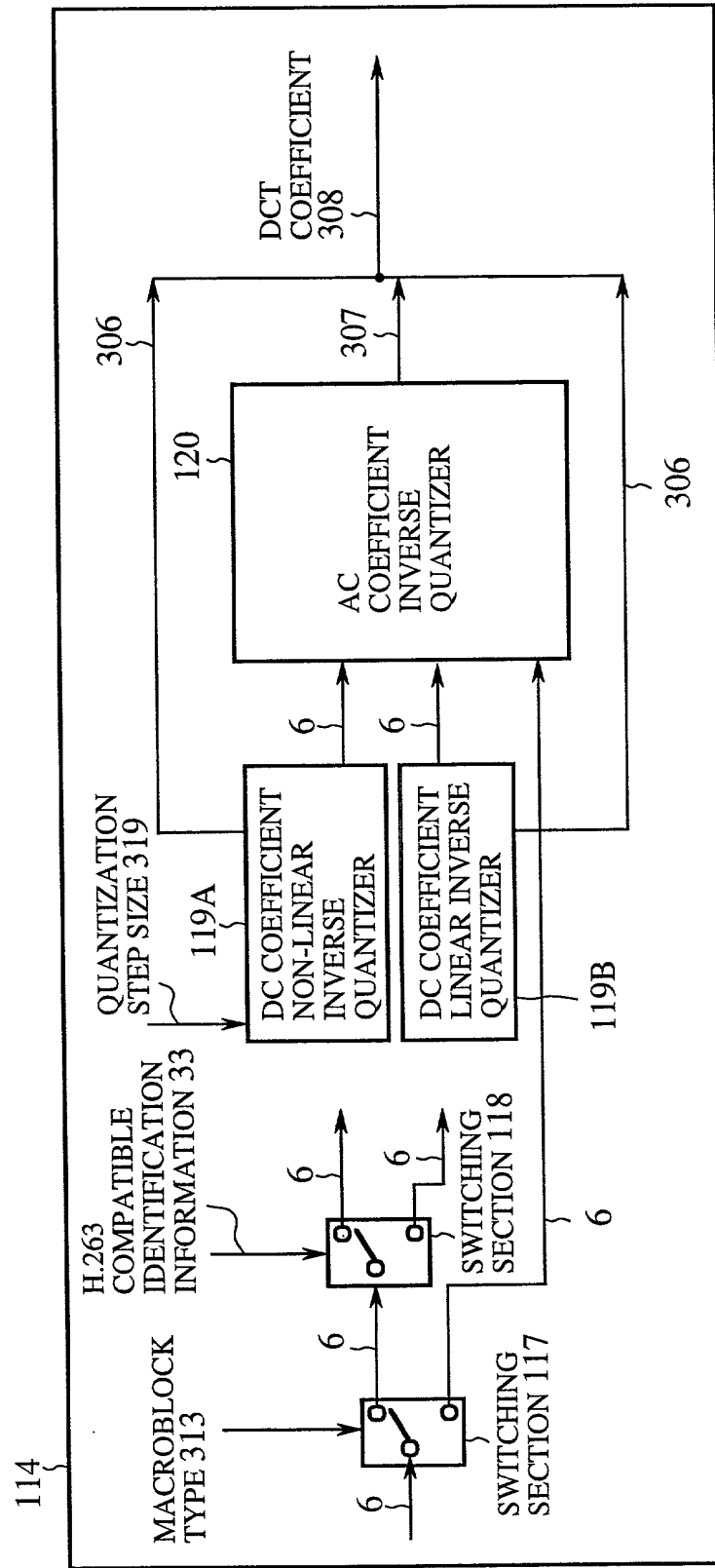


FIG. 19

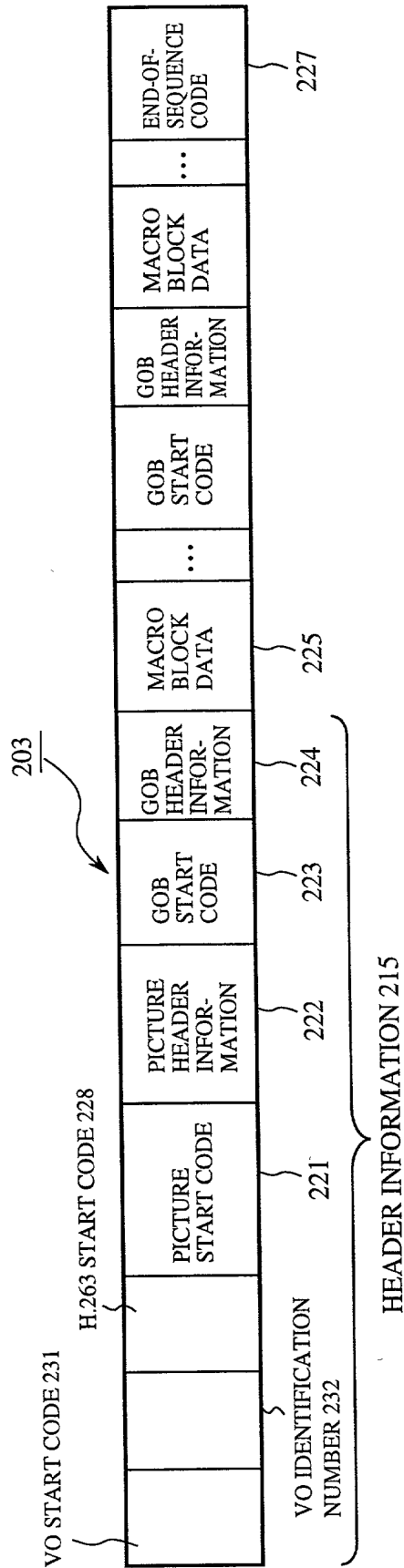


FIG. 20

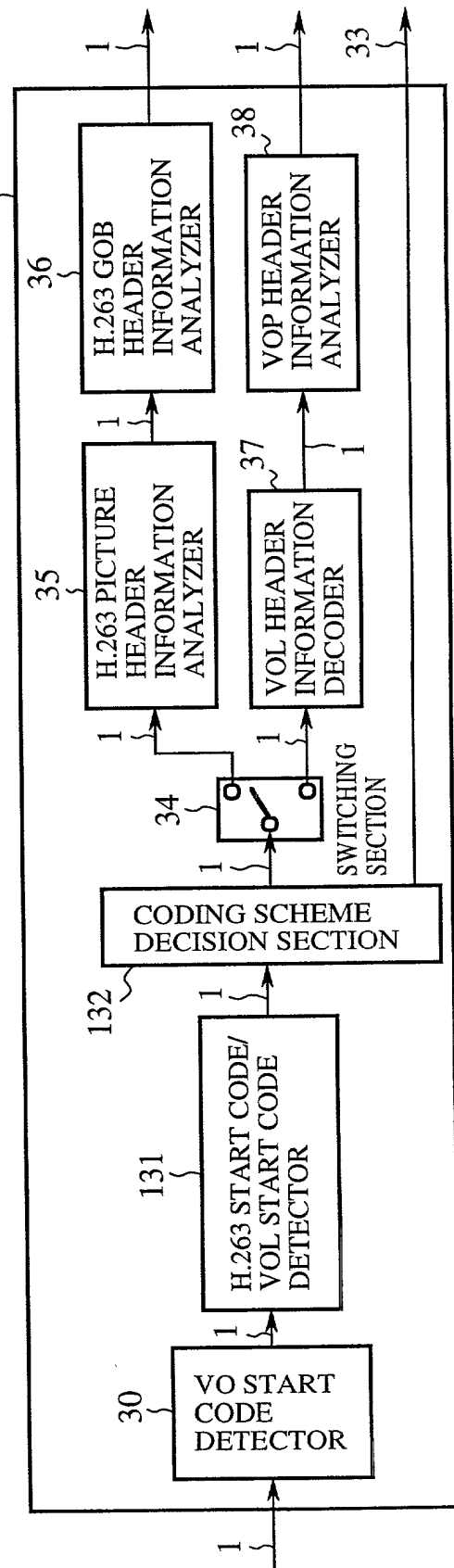


FIG.21

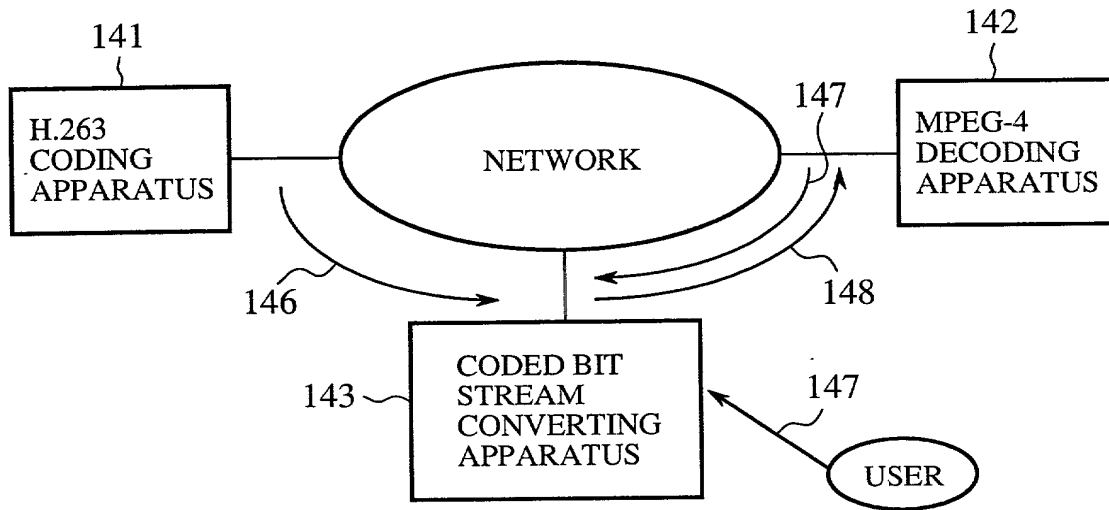


FIG.22

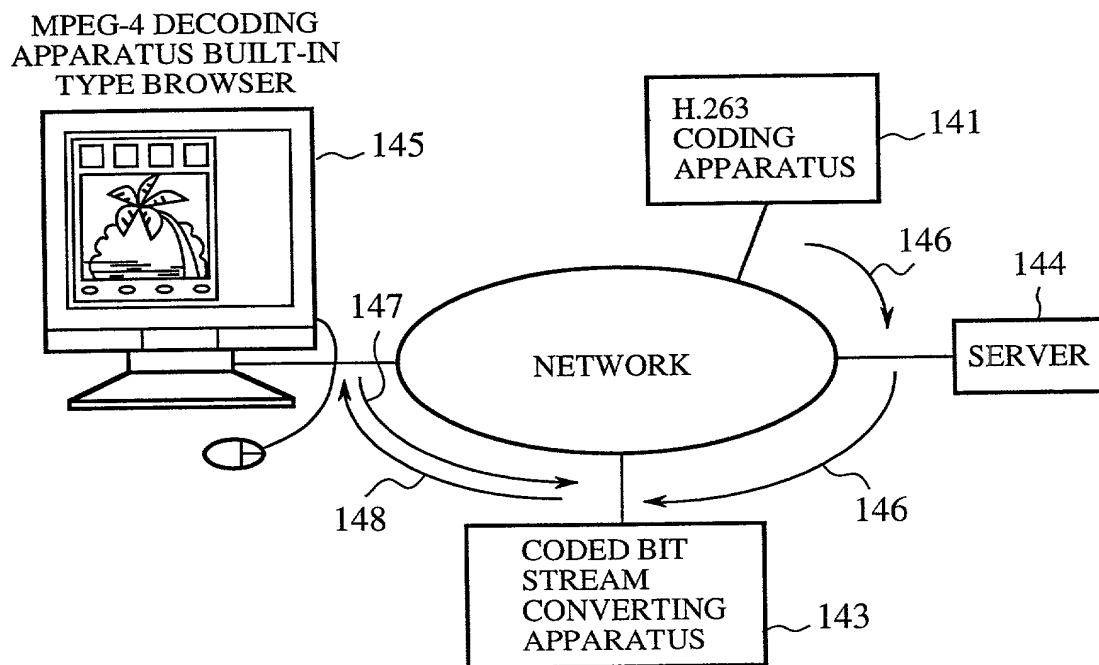


FIG.23

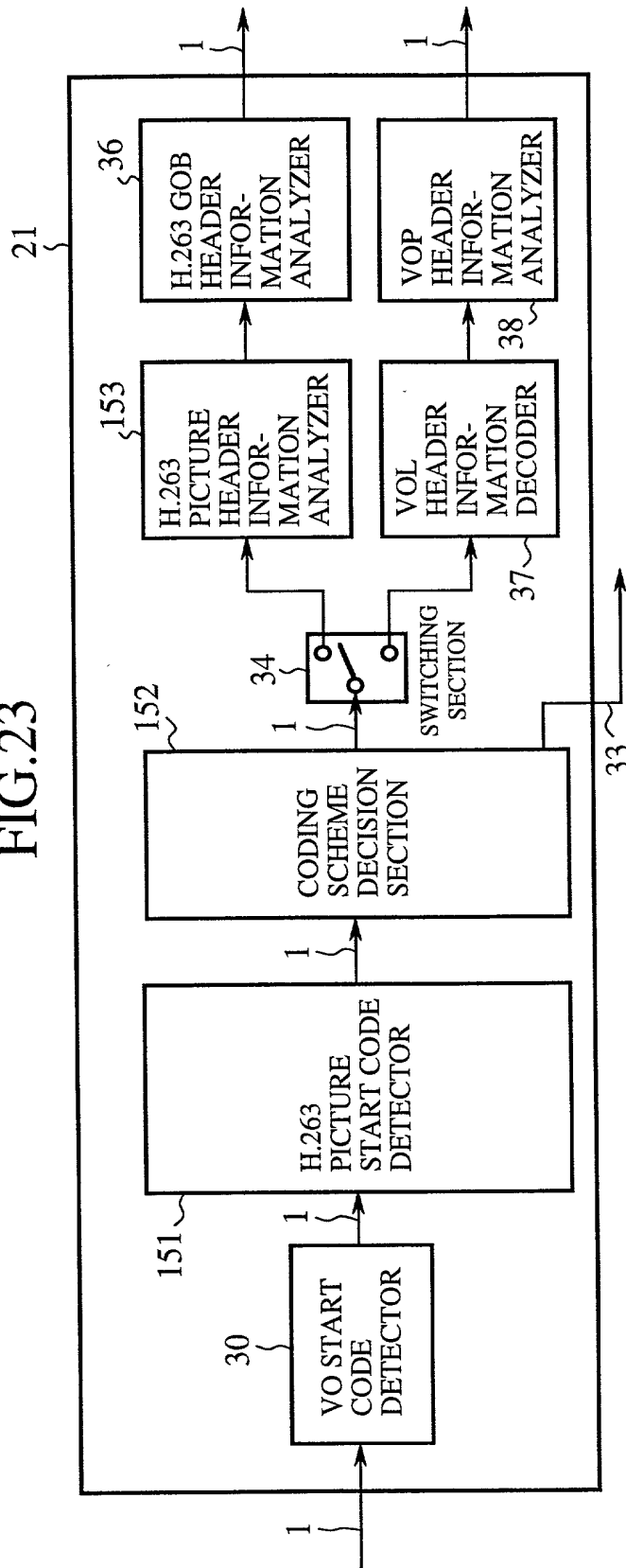
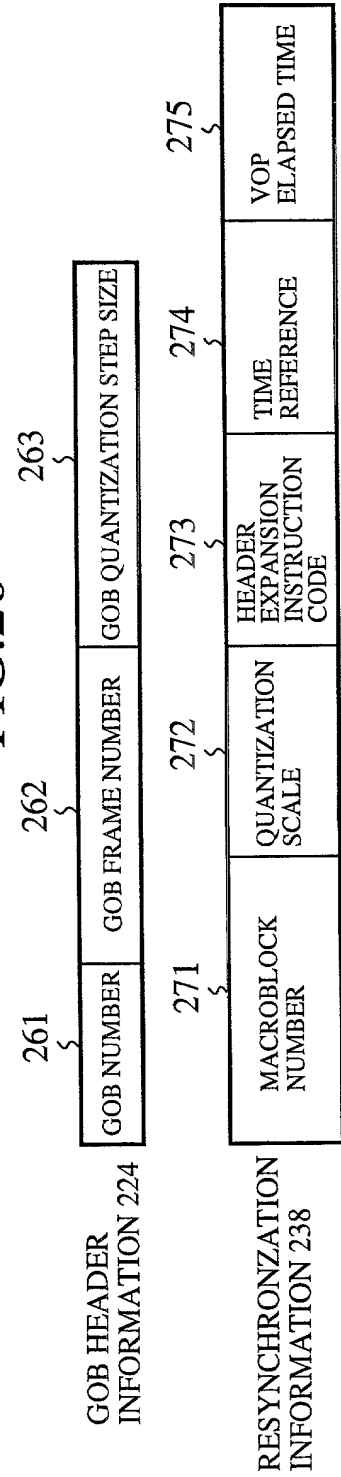


FIG.26





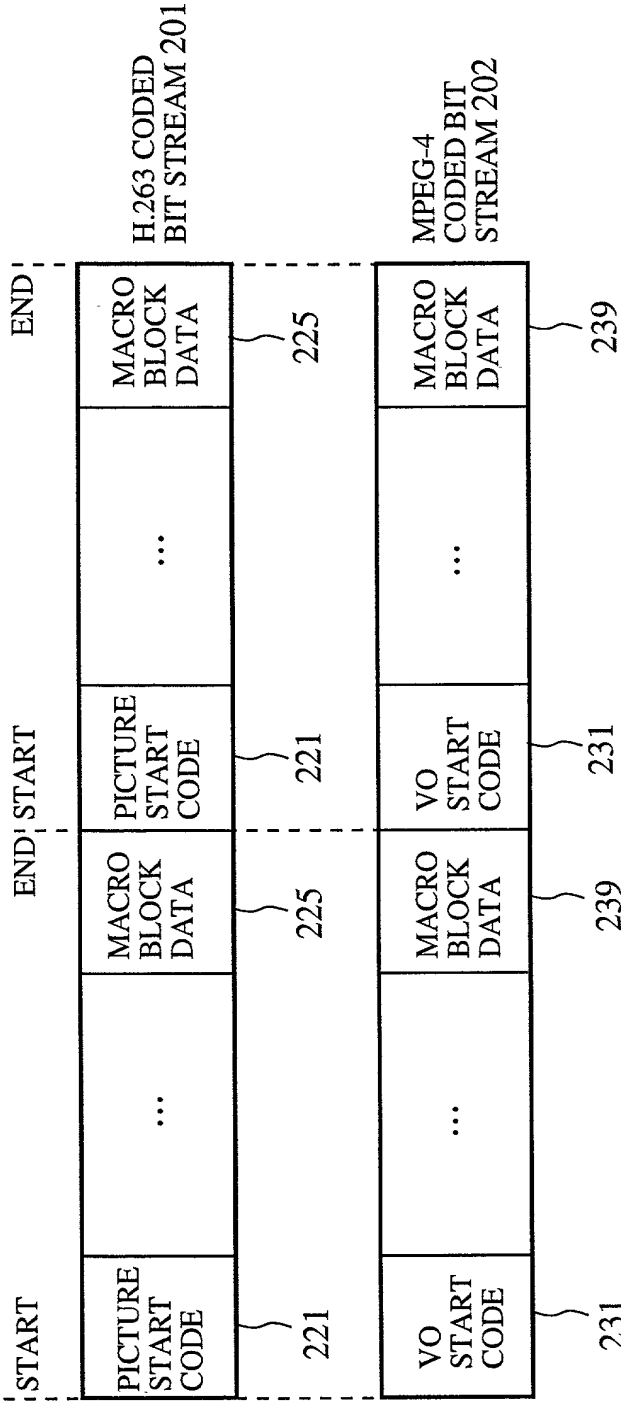
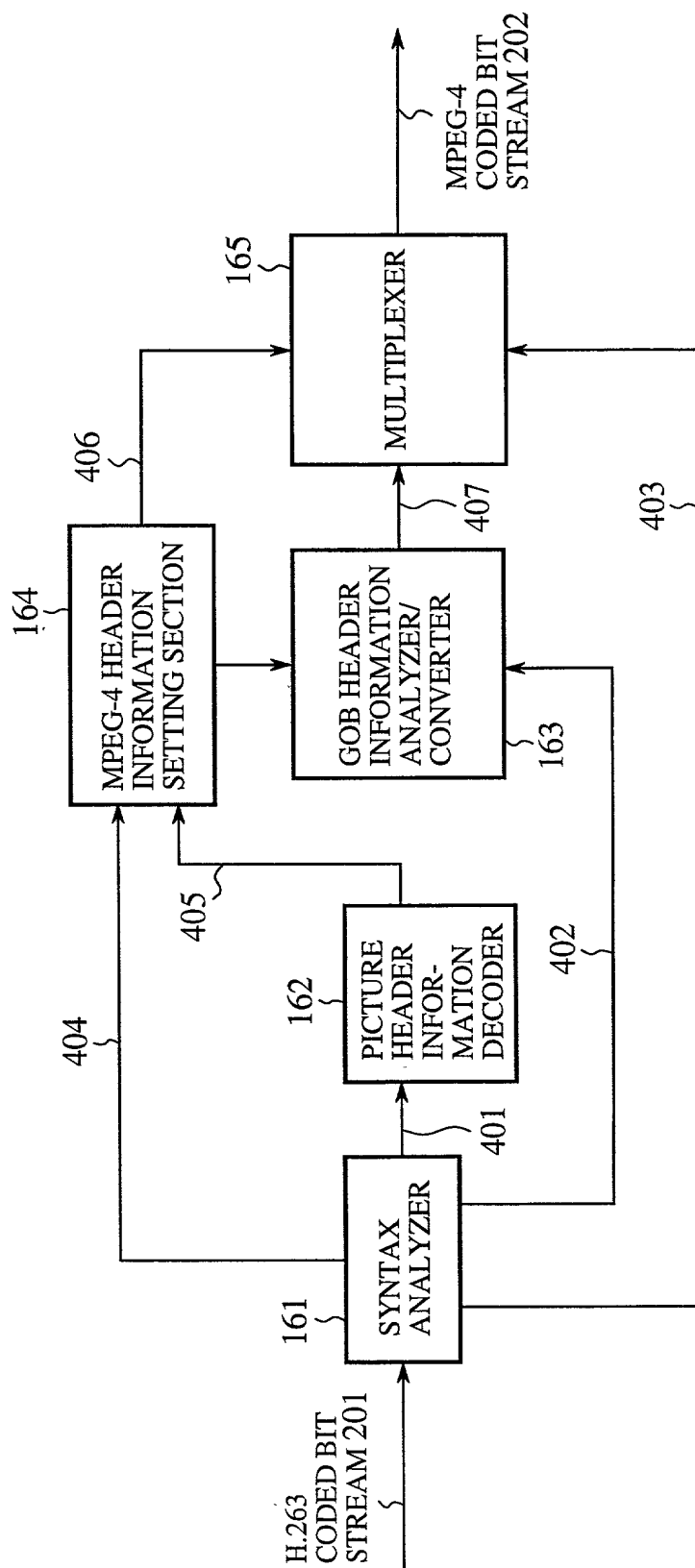


FIG.24(a)

FIG.24(b)

FIG.25



Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

## Declaration and Power of Attorney For Patent Application

### 特許出願宣言書及び委任状

### Japanese Language Declaration

### 日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

As a below named inventor, I hereby declare that:

私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。

My residence, post office address and citizenship are as stated next to my name.

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者であると（下記の名称が複数の場合）信じています。

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

"IMAGE DECODING APPARATUS, IMAGE CODING

APPARATUS, IMAGE COMMUNICATIONS SYSTEM

AND CODED BIT STREAM CONVERTING APPARATUS"

上記発明の明細書（下記の欄でx印がついていない場合は、本書に添付）は、

the specification of which is attached hereto unless the following box is checked:

☐ 月 日に提出され、米国出願番号または特許協定条約国際出願番号を \_\_\_\_\_ とし、  
 （該当する場合） \_\_\_\_\_ に訂正されました。

☒ was filed on October 23, 1997  
 as United States Application Number or  
 PCT International Application Number  
PCT/JP97/03846 and was amended on  
 \_\_\_\_\_ (if applicable).

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

私は、連邦規則法典第37編第1条56項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

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## Japanese Language Declaration (日本語宣言書)

私は、米国法典第35編119条(a)-(d)項又は365条(b)項に基づき下記の、米国外の国の少なくとも一カ国を指定している特許協力条約365(a)項に基づく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示しています。

### Prior Foreign Application(s)

外国での先行出願

(Number) (番号)	(Country) (国名)
(Number) (番号)	(Country) (国名)

I hereby claim foreign priority under Title 35, United States Code, Section 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Priority Not Claimed

優先権主張なし

(Day/Month/Year Filed) (出願年月日)	<input type="checkbox"/>
(Day/Month/Year Filed) (出願年月日)	<input type="checkbox"/>

私は、第35編米国法典119条(e)項に基づいて下記の米国外の特許出願規定に記載された権利をここに主張いたします。

(Application No.) (出願番号)	(Filing Date) (出願日)
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I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application No.) (出願番号)	(Filing Date) (出願日)
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私は、下記の米国法典第35編120条に基づいて下記の米国外の特許出願に記載された権利、又は米国を指定している特許協力条約365条(c)に基づき権利をここに主張します。また、本出願の各請求範囲の内容が米国法典第35編112条第1項又は特許協力条約で規定された方法で先行する米国外の特許出願に開示されていない限り、その先行米国外出願提出日以降で本出願書の日本国内または特許協力条約国際提出日までの期間中に入手された、連邦規則法典第37編1条56項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of application.

(Application No.) (出願番号)	(Filing Date) (出願日)
(Application No.) (出願番号)	(Filing Date) (出願日)

(Status: Patented, Pending, Abandoned) (現況: 特許許可済、係属中、放棄済)
(Status: Patented, Pending, Abandoned) (現況: 特許許可済、係属中、放棄済)

私は、私自身の知識に基づいて本宣言書中で私が行なう表明が真実であり、かつ私の入手した情報と私の信じていることに基づき表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第18編第1001条に基づき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行なえば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに上記のごとく宣誓を致します。

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Japanese Language Declaration  
(日本語宣言書)

委任状: 私は下記の発明者として、本出願に関する一切の  
手続きを米特許商標局に対して遂行する弁理士または代理人  
として、下記の者を指名いたします。(弁理士、または代理  
人の氏名及び登録番号を明記のこと)

POWER OF ATTORNEY: As a named inventor, I hereby appoint  
the following attorney(s) and/or agent(s) to prosecute this  
application and transact all business in the Patent and Trademark  
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唯一または第一発明者名		Full name of sole or first inventor	
		Yoshimi ISU	
発明者の署名	日付	Inventor's signature	Date
		Yoshimi Isu	March 21, 2000
住所		Residence	
		Tokyo, Japan JPX	
国籍		Citizenship	
		Japanese	
私書箱		Post Office Address	
		c/o MITSUBISHI DENKI KABUSHIKI KAISHA, 2-3, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100-8310 Japan	
第二共同発明者		Full name of second joint inventor, if any	
		Shunichi SEKIGUCHI	
第二共同発明者	日付	Second inventor's signature	Date
		Shunichi Sekiguchi	March 21, 2000
住所		Residence	
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(第三以降の共同発明者についても同様に記載し、署名を  
すること)

(Supply similar information and signature for third and subsequent  
joint inventors.)

第3の共同発明者の氏名 (該当する場合)		Full name of third joint inventor, if any, <u>Kohtaro ASAI</u>	
同第3発明者の署名	日付	Third Inventor's signature <u>Kohtaro Asai</u>	Date March 21, 2000
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同第4発明者の署名	日付	Fourth Inventor's signature <u>Hirofumi Nishikawa</u>	Date March 21, 2000
住所		Residence <u>Tokyo, Japan JPX</u>	
国籍		Citizenship Japanese	
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第5の共同発明者の氏名 (該当する場合)		Full name of fifth joint inventor, if any, <u>Shinichi KURODA</u>	
同第5発明者の署名	日付	Fifth Inventor's signature <u>Shinichi Kuroda</u>	Date March 21, 2000
住所		Residence <u>Tokyo, Japan JPX</u>	
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第6の共同発明者の氏名 (該当する場合)		Full name of sixth joint inventor, if any, <u>Yuri HASEGAWA</u> <span style="float: right;">8-00</span>	
同第6発明者の署名	日付	Sixth Inventor's signature <u>Yuri Hasegawa</u>	Date March 21, 2000
住所		Residence <u>Tokyo, Japan JPX</u>	
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第7の共同発明者の氏名 (該当する場合)		Full name of seventh joint inventor, if any,	
同第7発明者の署名	日付	Seventh Inventor's signature	Date
住所		Residence	
国籍		Citizenship	
郵便の宛先		Post Office Address	
第8の共同発明者の氏名 (該当する場合)		Full name of eighth joint inventor, if any,	
同第8発明者の署名	日付	Eighth Inventor's signature	Date
住所		Residence	
国籍		Citizenship	
郵便の宛先		Post Office Address	